ELECTRICAL REVIEW

[ILLUSTRATED.]

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Jarmann's Electric Street Car System.

Jarmann, of London, has lately exhibited a model of electric street car of his own invention; it is somewhat difficult to judge of a system after such a simple trial, and especially from the incomplete informations which are at our disposal, says *La Lumiere Electrique*, the chief feature of said system lies in the arrangement of the motor: the axle carries two movable armatures, each one revolving in an especial field by itself, and each one being also provided with a pair of brushes, (Fig. 1.)

According as one or the other pair of brushes is being connected with its current collector, by the means of a reversing gear, the current passes into one or the other armature, the rotating then taking place sometimes in one direction and sometimes in the other.

By such an arrangement, the inventor avoids the using of a reversing gear, or of two pairs of brushes with a single armature; the inactive armature serves also as a fly wheel.

We confess our inability to understand such a contrivance; so long as they have recourse to two pairs of brushes capable of being interverted, where is the use for two armatures and two fields?

The slackening of the armature speed down to that of the carriage axles is one of the greatest drawbacks to be met within the applying of electric motors to the pulling of cars and the electrical engineers who have had recourse to cog-wheels have only done it with the utmost care, trying at the same time to reduce as much as possible the metallic noise or the shocks. Mr. Jarmann does not hesitate to make use of a double set of cog-wheels and pinions (Fig. 2), and in order to reduce the friction he use spin cog-wheels,

The Wintry Days Do Not Disturb the Electric Light Man.

Whenever a cold snap comes snarling down from the northwestern wilds, and bites our ears and toes, freezes the water pipes and eats up our coal piles with such greediness, there are three classes of honest, hard working citizens who have some cause for hearty rejoicing. The coal man rubs his hands with glee at the grand procession of parties who want loads a little better if possible than the last; the plumber with his assistant, his tobacco—assorted kinds—and his memoranda bill book, is up and abroad early, with three well defined duties before him: such as flirting with the Imperatrice of the kitchen, charging three or four hundred per cent. for solder and smoking a well colored pipe in every room in the house; and thirdly the honest electric light man, who knows that whatever may have been the case at other times and in other weathers, while the cold wave is a sojourner, there is little danger to person or property from any cause with which he may be connected.

Gas meters may be blown up, overheated stoves and deflective flues, thawing out water pipes and the explosion of water backs may start the fire worshippers on their noisy, rattling run, and cause the insurance agent a pang, but the electric light man feels far differently from what he did during those drizzly weeping days before frost.

National Electric Light Association.

A special meeting of the Executive Committee of the National Electric Light Association was held at the Hotel Dam, in the Electric Club rooms, last Thursday afternoon, January 6. Messrs. De Camp, of Philadelphia; Ridlon, of Boston; McCoubray, of Baltimore; Lynch, of New York, and others, were present, and an earnest discussion was entered into relating to the work of the convention to be held at Philadelphia, February 15. Chairman De Camp was authorized to issue all necessary printed matter for announcing and advertising the meeting.

An important matter, that of the exhibition of plans of electric light stations, was discussed at length, and it was decided to make a special effort to have a large number of these plans exhibited, after which the committee adjourned.

Economy of Electric Light Over Gas.

On Friday evening last a lecture was delivered in the Royal Institution of South Wales before the Swansea Scientific Society by Mr. Polyblank, foreman of the Swansea Harbor Trust Works. In the course of his address Mr Polyblank quoted the following

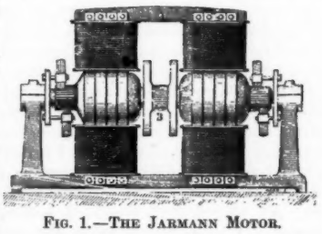


FIG. 1.—THE JARMANN MOTOR.

figures as representing the actual working cost of an arc lighting installation at the works of Messrs. Kitson, the well-known locomotive engineers of Leeds. The installation consists of a No. 7 Brush dynamo supplying twelve arcs and a No. 5 machine supplying six arcs, the armatures being of the obsolete type. Each machine is coupled direct to a Parsons high-speed engine; these have now been running for over five years at an extremely small cost for repairs—in fact, all that has been done to them has been to let up the crank-pin bearings once a year. The repairs to the dynamos have been of an equally negligible character, and only one pair of brushes has been used per annum. There is no vibration when running, and no foundations were put in. The plant is in charge of a laborer, who supplies the oil required once a day, and has practically nothing further to do. As to the cost, using positive carbons at 3d. per foot and negative carbons at 1½d. per foot, in 16 hours, 2 feet of positive and 1 foot 2 inch of negative are consumed. This makes the cost of carbons per lamp per hour 0.48d., the boiler evaporates 9 lbs. per pound of coal at 6s. per ton, and the Parsons direct acting engines use 40 lbs. to 50 lbs. of steam to the actual horse-power; this brings the cost of fuel to 0.16d. per lamp per hour. The oil used per 8 hours run in the two engines is two pints at 2s. 6d. per gallon, the water cost 6d. per 1,000 gallons, and the attendant gets 18s. per week. Summing up the working expenses on the above basis we get for a 60 light installation: carbons, 0.48d.; fuel, 0.16d.; water, 0.03d.; oil, 0.09d.; attendant and repairs, 0.24d.; a total of 1d. per lamp per hour for working expenses. Messrs. Kitson, in making the comparison between the economy of electric light over gas, state that in Leeds gas costs 1s. 10d. per 1,000 cubic feet, No. 3 burners being generally used at the works, which are said to give 16 candle light and to use 3 cubic feet per hour; it therefore requires 125 burners to give the same light as one arc lamp, and adding one-sixteenth for rent of meter, the result is a working cost of 8⅞d. per hour for gas to give the same light as afforded by one electric lamp.

Lighting Harvard College by Electricity.

The long mooted question regarding the lighting of the college library at Harvard, and the complaints concerning the uselessness of the books during six hours of every winter day, is now to be settled. Gore Hall is soon to be lighted at night. The *Daily Crimson* says:

"It is now possible to state with a great degree of certainty that this drawback will be removed and that the college library will

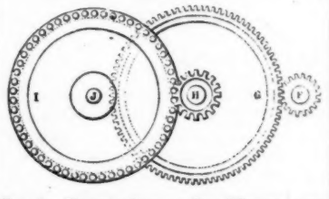


FIG. 2.—DOUBLE SET OF COG WHEELS AND PINIONS OF JARMANN'S SYSTEM.

be lighted with incandescent electric light. For some months past the authorities have been investigating the feasibility of such a plan and have now determined upon adopting it. The one great difficulty in their way was the absence of any available funds for putting light of any kind into the library. But Harvard never lacks friends in need, and a number of gentlemen were found who were willing to contribute for so worthy a purpose. It is but two weeks ago that the fund which amounts to $2,000 was assured. It was collected in sums varying very much in size, but all given with the same feeling that Harvard may no longer have a dark library.

"It is not possible to give perfectly accurate details about the distribution of the light in Gore Hall, but some of the following facts will be found reliable.

"Each table in the reading room will be supplied with two or more lamps which can be lighted or turned off at pleasure. At the head of every stack of books in the reserved alcoves will be placed a lamp with reflectors sufficiently strong to light up all the books under it. It is also possible that some fixtures will be hung from the ceilings for lighting up the hall generally.

"The space in which the delivery desk, the catalogues and the general reference works are, will be copiously lighted with stationary fixtures. The 'stack,' which is much less apt to be used at night, will be supplied with transferable lamps which will be attached by a long wire to the end of each stack of books and may be carried along in the hand."

The Electric Club.

INTERESTING DISCUSSION ON "THE INSTALLATION OF ELECTRIC LIGHT PLANTS."

The regular monthly meeting of The Electric Club was held at the club-rooms in the Hotel Dam, Thursday evening, January 6. An elaborate dinner was enjoyed in a very pleasant and informal manner, after which a very interesting discussion ensued. Among the prominent members of the club and visitors present were the following-named gentlemen: H. C. Davis, Geo. W. Hebard, J. B. Powell. H. R. Garden, C. B. Coggeshall, H. B. Miller, Jackson Bailey, Geo Worthington, H. N. Reed, A. C. Fowler, W. D. Sargent, J. C. Riley, C. D. Haskins, Geo. Manson, C. O. Baker, Jr., Henry Hine, William Hine, Charles W. Price, R. H. Worthington, Chas. Perring, M. W. Goodyear, E. T. Lynch, Jr., of New York city; Messrs. A. J. De Camp, W. E. Sharpe, J. C. Mathews, S. B. Richards, Stephen D. Holbrooke, of Philadelphia; Arthur Steuart, James L. Steuart, T. McCoubray, Baltimore; F. A. Cheney, Troy, N. Y.; Frank Ridlon, A. F. Upton, T. B. Doolittle, A. V. Garratt, Boston; H. B. Lytle, Providence; N. T. Pulsifer, Hartford; Frank Laughlin, Pittsburgh, Pa.

In the absence of the author, Mr. Jno. Beane of the Mather Electric Co., the paper of the evening was read by Mr. Henry Hine of the United States Company. The paper is given below:

"THE INSTALLATION OF ELECTRIC LIGHT PLANTS."

It has been announced that I am to read to-night a reply to the paper presented by Dr. Benjamin at the last meeting on the subject of the rules governing the installation of electric plants. I was not here at the meeting but read the rules as published in the ELECTRICAL REVIEW in a recent number. I feel that the thanks of the club are fully due the Doctor for bringing before it so interesting a subject—one which cannot be too frequently discussed in the proper spirit—unbiased by interested motives—prompted by a sincere desire to still further increase the safety of electric lighting.

I have not examined these rules as carefully as I could wish owing to lack of time, but they appear to me to be in effect, practically, those which are pretty generally in use in this country at present.

Referring to Rule II, at first thought it would seem better to limit the size of conductor by a certain excess of temperature above the air in which it is placed, say 50° F., for the difference in temperature of a wire in winter and summer must make a difference in its carrying capacity, and I think this a proper subject for discussion. There is another matter which is well worth considering seriously, and that is whether it is not safer, at least, in cases where low potential currents are used, to place the positive and negative leads close together, separated by a thin septum of some material of high insula-

ting resistance, than the present method of using underwriter's wire, and a half-inch septum of wood.

In regard to the inspection of electric light plants, as is well known, there is lack of uniformity in the requirements of the boards of fire underwriters throughout the country, and as to their enforcement in many cases it would seem as if no inspection was made at all, or, at least, in a very perfunctory manner. I regard the proper inspection of installations as of much value to the electric light companies, and believe that no plant—no matter where located, nor how small—should escape.

This matter of uniformity in the rules of the boards of fire underwriters, and, what is more important, their impartial, rigid enforcement, is one which should claim the attention, and calls for the united action of the electric light and power companies.

I refer here simply to the necessity of more uniformity in the rules enforced in different parts of the country, and do not wish to be understood as endorsing any of the wild statements I have seen published in some of the daily journals recently, setting forth the terrible havoc of the electric light, both as to property and life.

It is hardly worth while to treat these assertions seriously—the time has gone by when it would be necessary to do so—to set the matter in its proper light before the public.

As to the dangers from fire, I have only a word to say—the losses from fire in this vicinity during the past five years have amounted to the value of twenty-five millions of dollars ($25,000,000) During the same period, and in the same territory, the losses due to electric light currents have reached the enormous (?) value of four thousand dollars ($4,000), and there are more electric lights here than in any territory of equal size in the country.

To show you how exclusive a lien the authors of these statements referred to have upon this made-to-order-fire-fiend of the electric light, I will call your attention to the fact, which is well known to you all, that fire insurance companies in New England and in and around New York make a reduction, in a large number of risks, in the rates of insurance where the electric light is installed instead of other illuminants.

As to the terrible loss of life, the entire number of deaths from high tension electric light currents since lighting by electricity has become a commercial occupation, can be counted on the fingers of the hands. Let us consider other illuminants—oil or gas; the merest tyro cannot fail to see the absurdity of the comparison as in favor of the electric light. Let us bring the matter right home to New York, and we find that the coroners' reports for four or five years past record deaths due to gas (excluding suicides) numbering at least twenty (20) per annum.

If we consider the fatalities among engineers, machinists, miners, carpenters, painters, masons, etc., the comparison becomes most marked in favor of the electrical engineer. It is not my desire to belittle the dangers of high-tension currents, but I must protest against their exaggeration. With the safeguards that are now employed in their manipulation, the possibilty of fatal shocks are indeed few; but as to making the occupation of electrical engineer an absolutely safe one, we might as well attempt to make existence absolutely safe from fatal accident. Of course, the old saw-mill admonition in relation to undue familiarity with the buzz-saw while in motion applies, in principle, equally well in the central electric light station.

THE DISCUSSION.

Mr. A. J. De Camp, of the National Electric Light Association, was called for on the conclusion of the reading.

Mr. De Camp—It is very unfortunate that Mr. Beane is not here, but at the same time I think he said just about all that could be said on this subject. He states the facts. People may say to me that I may drop down dead or may be struck by lightning tomorrow; but I have lived some forty-five years and have not been struck by lightning. Therefore I do not let such things worry me The thing of greatest importance that I see in connection with this is the excitement of the insurance interests on this point. I think that I would feel just the same way. In the matter of electric lighting they are insuring against a risk of which they really know nothing, and like all of us they are prepared to give themselves the benefit of the doubt. Recently in Philadelphia, without any known cause, they have advanced, or attempted to advance the rates from ¾ to 1¼ per cent. for no other reason than the fact that the station is an electric light station. They cannot for the life of you give any other reason if they are pressed to the point. But I suppose they say these people cannot do without insurance. If they cannot get it at ¾ they will have to pay 1¼. So far as our own company is concerned I do not think that we have had the first blaze of fire from the electric current, and we have not had one accident in our electrical department where we have had five in our mechanical department.

Mr. Ridlon—With regard to this question of fire risk, I shall have to refer to the Manufacturers' Insurance Company of New England, which insures a large portion of the mills. Their risks have amounted to some thirteen or fourteen millions of dollars within the last two or three years. From a statement that I saw of one of their inspectors, their loss during that time had amounted to less than $14. As Mr. Atkinson says an electric light fire is what he considers a safe fire. The moment that anything in an electric light circuit from any cause whatever, produces a spark of fire, the apparatus is immediately stopped, and the cause is looked after, and it is found that it has simply charred portions of the wood, and it is easily repaired and started up again. Whereas, with other lights a fire occurring in a mill or manufacturing establishment, the gas pipe is melted off, or the oil lamps are broken, and this immediately adds a large amount of fuel to the fire, causing the complete destruction of the mill The New England Insurance Exchanges have proposed to reduce the rates of insurance very materially, to any party using electric lights exclusively. I consider this a very conclusive in regard to the safety of the electric light. [Applause.]

Mr Hebard—I am not prepared this evening to do more than express my entire sympathy with what has been said on this subject and particularly to refer to that part of Mr. Beane's paper wherein he so forcibly calls attention to the very small amount of loss by fire caused directly from electric lighting circuits as compared with the aggregate loss from fire for the same period in the same district. This is the more phenomenal when we consider that this period covers a time when this new industry has been passing through its earliest childhood, surrounded by all of the limitations attending a new thing with which people at large are entirely unfamiliar. Yet, notwithstanding the ignorance of the people who erect the circuits and the ignorance of the people who use the lights, we still have this phenomenal result—I think I may say it without hesitation—that in the five or six years since the first introduction of electric lighting in any commercial sense, there has not been a single instance where conflagration of any extent has even been attributed to the electric circuits. As has been properly said by our friend from Boston electric fires are safe fires; they are quickly found and extinguished, and there is nothing in connection with electric circuits to feed fires. One word in regard to the underwriters. The great trouble with the underwriters is the ignorance of the people. What we want to do is to have them educated, and I suggest that the next time that we have a meeting and propose to talk about this matter that we each get a good friendly underwriter under our arm and bring him here, and give him a good dinner, and tell him how it ought to be done. (Applause.)

Mr. Steuart—There is a fire insurance company at home that I have something to do with. I have advised them that electric lighting is about the safest sort of illumination, and on that basis they are charging factories that are using the arc lamps no more than they charge any one else.

Mr. Upton—I notice that these fires all occur in stations that use long-stroke engines and line shafting. [Laughter and applause.] There is only one remedy—use direct-acting engines with no line shafting, and you will have no fires at all I will take the opportunity of stating now that Mr. Sprague will read a paper on this question of power at the next Electric Light Convention, to be held at Philadelphia in February. He has promised me that he will do so.

Mr. De Camp asked for an expression of opinion from members as to alternating and constant currents in respect to their relative tendency to cause fires. He had been informed by an eminent scientific man that the alternating current was about three times as dangerous as the constant. In other words, one volt of alternating current, so far as insulation, danger of fire, and danger to person and property were concerned, was equal to three volts of a constant current. Subsequently, he had asked the opinion of another equally eminent scientist as to the difficulties of insulating with an alternating current, as compared with a constant current, and the reply was, "It was much easier."

Mr. Ridlon—I have been investigating the alternating current within the last two weeks. Now, the best statement that I get is 1,000 volts in an alternating current will equal 1,500 volts in a constant current. Now, the question of safety arose, and we called the inspector of the Insurance Exchange to inspect a plant that is now being put in by the Sun Electric Light Company, and he made a very thorough investigation—went through the different houses where this installation is placed or where the lamps are placed from the Central Station, in a distance of half a mile to a mile away from the station, and examined it very thoroughly. Now, Mr. Brophy is an authority in New England on inspection, and the verdict he rendered was that it was absolutely safe.

Mr. Garratt—In a general way I would say that where wires are not placed close together an alternating current of 1,000 volts or 1,500 or 500 volts, would be equally safe with a direct current of the same potential. Where wires lie close together the danger is increased. Now, reverting to the matter of the danger of fire, I would say this—that a comparatively low potential with an alternating current would terminate in a fire where a direct current might not do so. I would not for a million dollars take an alternating current of a thousand volts through my hands. I would take that amount very readily of a direct current. I wish to emphasize the fact brought out by Mr. Ridlon that it is impossible for an electric current to produce a fire—unless it be by the heating of a small piece of wire—without giving instant notice to people using the lights that something was out of order. As soon as we get a short circuit which draws an arc, the greater portion of the current follows over that arc. The lamps immediately show evidence of there being a short circuit, and it is my opinion that it would be wise in all circuits of any magnitude to have a switch whereby in case of the lamps acting abnormally a person could run to a large switch and break the whole circuit controlling the building in which the lights are placed.

Mr. Beane having come into the room was called on by the chair to address the meeting.

Mr. Beane—I do not know, gentlemen, that I care to say anything further than what I have said in the mattter. I think that the dangers of electric lighting have been greatly exaggerated, and I so stated in my paper. The matter is one which I consider of a great deal of importance. Of course it is due to ourselves that we should not permit this idea to go out to the community that electric lighting is unsafe, but it seems to me that we have got past the stage where the public would look upon the matter in this light.

Mr. Garratt—I wish to say that the only two cases of fire from electric light that came under my notice were on long circuits. They were discovered by variation in the light. The employes immediately hunted around and found the place where the fire was before it had burned up two dollars worth of property To refer once more to the subject of alternating and constant currents, I cannot say in an unqualified way that the danger is no greater with the alternating current than it is with the direct current. But I will say simply this—that I should use a little more caution in the installment of an alternating current than I should with a direct current. The alternating current produces induced currents in all conductors in its immediate vicinity. That conductor may be anything in which an induced current is capable of being produced, and the danger would arise from unforeseen and unknown possibilities of induction which the man is not aware of I do not think the danger is great enough to enter seriously into the question of discontinuing the alternating current. I do not think the danger of the alternating current is nearly so great as is urged before the public. The danger to human life is extremely great. It is dangerous to tamper with the alternating current, much more so than is generally known. It is much safer with the direct current than is generally known. This is a point which should be emphasized very strongly to those men who are working constantly with wires carrying the two kinds of currents. I do not think there is much danger with an alternating current not exceeding two thousand volts in potential. If I were a fire insurance man I should consider the alternating current the greater risk, all things being taken into consideration.

Mr. Ridlon—I would like to ask if the safety fuse could not be used in connection with the alternating current to prevent the dangers referred to.

Mr. Garratt—The safety fuse could be used with the alternating current, with what safety I don't know. The safety fuse is not put in to control electro-motive force, which is the quality that causes the current to jump from one wire to another, and set fire to any intermediate substance. The safety fuse simply protects against any lamp or any portion of the circuit carrying a greater amount of current than it can carry with safety.

Mr. Ridlon—It would seem to me that the insurance exchange might, through its inspector, give us a set of rules whereby we should run our wires in connection with the alternating current, so as to insure safety from fire.

Mr. Garratt—I would not recommend applying to the Underwriters' Association for a system of rules, for the reason that they would go to a theoretical electrician—some recognized authority in the country—and he would work out a system of rules which might be entirely inappropriate. We might prepare ourselves a table of the requirements which are perfectly safe in the opinion of electricians, and also feasible in the opinion of men skilled in installing plants, and get the underwriters to adopt that.

Mr. De Camp—When we look back to the time when the present rules were formulated, the original purpose was to have arc light wires six inches apart. That was pretty generally accepted. But the insurance companies were not satisfied, and it was made eight inches. There is just as much reason for making that eight feet as eight inches. I think, if the thing is referred to insurance companies, our wires are as likely to be strung on both sides of the street as in the same building. I think at the same time the insurance companies are not disposed to be very captious in the matter, and if a new set of rules were submitted by men eminently qualified to give an opinion on the subject, and who in the opinion of the insurance companies were disinterested parties, that they would be very apt to accept whatever those gentlemen would suggest.

Mr. Garratt—I would be willing to stake what little professional reputation I have, that any electrical system now in use in the United States that I know of—arc or incandescent, alternating or direct—would be a safe installment, if its wires were at al

points one inch apart in all portions of the circuit.

Mr. Hebard—Was it not the desire on the part of the underwriters, in requiring those wires to be so far apart, to render it unlikely that a trifling amount of moisture might make a short circuit, whereas if the wires were a little farther apart it would be less likely?

Mr. Garratt—I presume it was, sir. But there is nothing to prevent a perfect insulation of the wires from a practical standpoint. There are several wires on the mar ket that are practically perfectly insulated, so far as electric light currents are concerned.

Mr. Hebard—That was not the state of affairs at the time these regulations were formulated?

Mr. Garratt—No, sir.

Mr. Hebard—The point I wanted to make was this: don't let us make it possible for the underwriters to say that we are here as a close corporation or as a mutual admiration society, talking only on one side. Another thing—in putting up circuits, how often do you know that the carpenter is not going to make short circuits for you in putting in nails? In one sense it is a distinction without a difference we are talking about; but at the same time there is a distinction there that may very properly be talked over.

Mr. Garratt—It is as easy to argue on one side as the other. I was intentionally arguing on the side of safety of installation. With reasonable care, and with good, fair, honest workmen, a distance of an inch or two between wires properly hung is absolutely safe. I am supposing the installation is put up with all due care in attempting to prove that there is no danger from electric lighting. There is danger from any great power and as has been said greater forces are only handled safely with one condition and that condition is unceasing vigilance. This applies to electric lighting as well as to anything else.

Mr. Ridlon—That matter of distance has been taken up by the Insurance Exchange in such places as are ordinarily called damp places. I happened to know this fact by having to change a large amount of underwriters' wire that I had in a paper mill for water proof wire.

Mr. Upton—I have listened with great attention to all this discussion. I still come back to the point that there is not one single case where there has been a disastrous fire from electric lighting unless it has come from the shafting. [Laughter.] Your insulation is all right, and it all comes down to the question of using line shafting.

Mr. De Camp—Unfortunately, Mr. Upton, the insurance companies don't recognize that.

Mr. Upton—They do not know their business; that is what is the matter.

Mr. Hine—Mr. Beane in his paper raised the question whether it is not safer to have wires near together than far apart. The argument is this—if wires are two inches apart, dampness may make a connection from one wire to another. The circuit formed is, however, too slight to materially decrease the resistance of the line and burn out the safety fuses; the wood becomes charred, and fire results. Whereas, if the wires were close to-gether there would be formed a short circuit, and there would be no danger. There is one other point. My understanding is that the question of heating a conductor of electricity is one entirely of quantity or current strength. It makes no difference whether it is alternating or continuous. It is simply a question of quantity. Therefore a safety fuse will operate equally well whether the current is alternating or continuous.

The Chairman—As to the question of dampness an experiment came to my notice—and it was an extreme one—in which two bare wires, with 110 volts on the circuit, were laid on a board about half an inch apart, forming a trough between them. Water was poured into the trough with the expectation that it would make a short circuit and put out the light. But it had not the slightest effect.

Mr. Haskins—It seems to me that Mr. Hine has struck the key note in regard to alternating current. The point is how much energy passes a given point in a given time. It makes no difference whether it is an alternating current or a direct current. The one is as dangerous as the other provided the same amount of energy passes a given point in a given time. I guess there is not a man in the room who has not had an alternating current pass through him of 50,000 or 60,000 volts. Any current that will jump an inch has an electromotive force of 50,000 or 60,000 volts.

Mr. Garratt—I maintain my point and am prepared to prove it that anything like an electric l ght current of 500 volts or upwards, alternating, is an extremely dangerous thing to fool with. These little magneto machines and helixes that are sold on the sidewalks to be sure have a high electromotive force, but they do not come within the question of electric lighting of which I have been speaking.

Mr. De Camp—I suppose the point is that if a gallon of whiskey is taken at one time it will have an effect; if it is taken during the day it is all right. [Laughter.]

Mr. Upton—I believe that every man who has been injured or killed by electricity attempted to commit suicide. That is all there is to it.

Mr. Pulsifer, of the Mather Company, was called on for a speech, and said:

I do not know that I ought to say anything here, for this morning I sent regrets that I could not come. I think that it is well, while we are considering this subject to bear in mind that it is pretty difficult work. I do not doubt that the insurance people feel kindly disposed toward all the electric lighting interests, but they show it sometimes in rather a peculiar way. It seems eminently proper that as electric lighting has advanced so far a conference should be had between the electric light people and the insurance people all over the country, and that some rules be laid down by which we could all be governed, and not be called upon to submit to different rules in one State from what we work under in another.

I do not understand much about alternating currents, but I can understand the illustration of the gentleman in regard to the gallon of whiskey.

You will have to excuse me for taking your time. The regrets I wrote are in my pocket. I am here, and you have the regrets instead of me.

Mr. Ridlon—The National Insurance Exchange, of Massachusetts, has agreed to reduce the insurance of all parties lighting by electric light by present regulations. Now, I have proposed it to the Insurance Exchange, of Boston, and they agree that we should invite the Insurance Exchange to our weekly, monthly or whatever meetings we have and discuss this thing with them. I think they are all ready to discuss it. They say this: "We are seeking after information. We make up our rules by such information as we can get. Now, we should be very glad to get information from you." If we could bring them here with us and discuss this subject I think that they would very readily fall in.

The chairman—Following Mr. Ridlon's suggestion, if each one of us at our next meeting will bring some member of a prominent insurance company—if you will bring one with you from Boston—it will not only double the attendance and lead to our having a pleasanter time, but we would have these matters thoroughly discussed. I hope the members will bear this in mind.

The Boston Electric Lighting Company.

It will be remembered that the consolidation of the Brush and Merchants' electric light companies, of Boston, was announced in these columns several weeks ago. The organizaton of the consolidated company has just been completed, and is as follows: Directors—Isaac Fenno, D. N. Richards, and H. O'Brien, of Boston; William Butterfield, of Center Harbor; Edward Maltby, of Taunton; F. A. Gilbert, James English and H P. Frost, of New Haven, and H. F. Hyde, of Springfield.

President and general manager, F. A. Gilbert; vice-president, Hugh O'Brien; treasurer and clerk, S. S. Sias; superintendent, P. Fahey.

The Theory of Combus ion of High Explosives.

To the Editor of the Electrical Review:

The perusal of Dr. Benjamin's interesting paper (in the REVIEW of Dec. 28, 1886) on the "Firing of High Explosives," suggested to the writer that possibly a popular explanation of the fact therein brought out, that there were two distinct classes of explosives—those in which the explosive was converted into gas, somewhat gradually, and those in which this change took place almost instantly—might not be out of place.

The question is a very interesting one, for it involves at least two of the most beautiful ideas of modern chemistry—ideas which are being arduously followed out in detail, by many of the leading scientific investigators of the world. I refer to the beliefs that the atoms which make up the molecule of a substance, have a definite arrangement, or po-ition, within the molecule, and that this arrangement or position is due to a polarity innate to the atoms themselves.

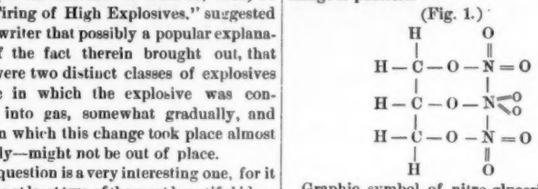
Now, it often happens that this arrangement of the atoms within the molecule may be such that, although the compound seems to be stable enough under ordinary conditions, yet, on very slight provocation, the atoms can be made to re-arrange themselves in a position in which they will occupy many hundred times as much space as they did before.

Let us, for example, consider two well-known explosives—common gunpowder and nitro-glycerine. These stand at the opposite extremes as to rapidity of explosion, and yet, in a general way, the chemical action in the two cases is much the same—carbon and hydrogen unite with oxygen, large volumes of gas are liberated, and great energy is set free.

In the case of the slow explosive, the carbon and oxygen are in different molecules, and it is necessary for those on the outside of the grain of powder to burn up before those underneath can get on fire, and so on, until the molecules at the center have been consumed. For this reason, gunpowder, intended to move small projectiles, with small inertia to overcome, is made in small grains, which will burn up quickly, while the powder used in heavy ordnance is made in grains as large as a hickory nut, so that it cannot burn faster than it is able to move the heavy projectile. Now, in the case of nitro-glycerine, the carbon and oxygen atoms which are about to unite, are in the same molecule. In the case of the gunpowder, the carbon is oxidized, molecule by molecule, as it burns away. In the case of nitro-glycerine, the hydrogen and oxygen, and carbon and oxygen, unite almost instantly, throughout the entire mass. And this fact leads us up to the principle I have already stated that a molecule is not only composed of a definite number of atoms, but these atoms have a peculiar and invariable arrangement within the molecule.

Nitro-glycerine has been analyzed and its molecule is known to be $C_3 H_5 N_3 O_9$. And to those unfamiliar with chemical nomenclature it may be said that this symbol simply means that in each molecule (or smallest mass of the substance that can exist uncombined) there are three atoms (or smallest masses that can enter into combination) of carbon, five atoms of hydrogen, three atoms of nitrogen, and nine atoms of oxygen. Now these atoms are not jumbled together in any way to make up the little mass of nitro-glycerine which cannot be over $\frac{1}{2500000}$ of an inch in diameter, but are grouped in a very definite way. Before we consider just how they are grouped let us see what can take place when nitro-glycerine explodes. There are three atoms of carbon, now these only require six atoms of oxygen to combine with, and here are nine atoms of oxygen right within the molecule. There are also five atoms of hydrogen which require only $2\frac{1}{2}$ atoms of oxygen, and there are three atoms of oxygen within the molecule that are not required by the carbon. Why then do not these elements combine at once and the nitro glycerine explode the same instant it is made? Surely there can be no reason unless it is that the carbon cannot get at the oxygen because it is in another part of the molecule, and the hydrogen cannot get at the oxygen for the same reason. Now if we arrange the atoms as in the following diagram we at once see that such a condition of things is possible.

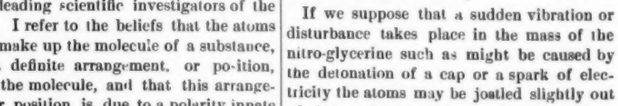
(Fig. 1.)



Graphic symbol of nitro-glycerine. The letters represent atoms of hydrogen, carbon, oxygen and nitrogen. The dashes represent bonds of chemical affinity.

If we suppose that a sudden vibration or disturbance takes place in the mass of the nitro-glycerine such as might be caused by the detonation of a cap or a spark of electricity the atoms may be jostled slightly out of place and may rearrange themselves thus:

(Fig. 2.)



Water. Carbonic dioxide. Nitrogen gas.

In which position they would occupy about nine hundred times as much space as they did before.

If you will count the atoms in diagram No 2 and compare them with those in diagram No. 1 you will see that to complete the reaction, one atom of hydrogen and one atom of nitrogen are borrowed from a neighboring molecule which was broken up at the same time.

There is nothing to prevent the whole mass exploding almost at the same instant of time. In practice it is found to explode in at least one-hundredth of the time required by the same amount of gunpowder, which in exploding would have expanded only about three hundred volumes.

An ordinary tomato can would hold enough nitro-glycerine to develop in exploding about 500,000 foot pounds of energy almost in an instant of time, a blow quite sufficient to shatter the hardest rock, supposing the charge to simply have been placed on the top of the rock and exploded. Under similar conditions the same weight of gunpowder would have liberated only about one-third the volume of gas doing the work of say 160,000 foot pounds, which work would have been distributed over at least one hundred times as much time, striking a blow of 1600 foot pounds instead of half a million foot pounds in the case of the nitro-glycerine explosion.

As was very aptly stated by Prof. Cook some years ago, while speaking on this same subject: "The instantaneous development of such a large volume of gas which at once becomes part of the atmosphere, has the effect of a blow against anything that may happen to be just below it, or rather acts as an anvil against which the object is made to strike a blow."

It may seem strange that the earth's atmosphere is dense enough to split a rock against, but such is the case if the blow is struck quick enough. He then went on to illustrate that we could move a surface of say a yard square through the air slowly without finding much resistance. If we run with it we feel some pressure from the air; if we increase the speed to the highest velocity attained by a locomotive (1¼ miles per minute) we would find a resistance which no human muscle could overcome; increase this ten times (to the velocity of sound), and a wooden board would be shivered to splinters, mul iply this velocity again ten times and not even a plate of boiler iron could withstand the pressure, multiply this speed again by ten, and we have the velocity of the earth in its orbit (about 1,200 miles per minute) at which velocity the atmosphere of the earth would offer an almost impenetrable barrier against which the hardest rocks might be broken into fragments—indeed this is sometimes seen to be the case when meteors moving with these planetary velocities enter

Continued on Page Eight.

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GEO. WORTHINGTON, - - - Editor
CHARLES W. PRICE, Associate "
LOREN N. DOWNS, President.
ANDREW J. DAM, - Vice-Pres't and Treas.
C. C. HASKINS, }
GEO. A. HAMILTON, } Consulting Electricians.
GEO. H. BENJAMIN, }

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The Indiana Legislature is now in session; telephone companies should keep an eye on this body of statesmen.

One of the most valuable and most instructive and interesting journals of the day is the ELECTRICAL REVIEW, published weekly in this city.—*New York Sun.*

The Government expects to begin preliminary proceedings against the Bell Telephone Company in Boston this week. The counsel will be District-Attorney Stern, of Boston, and Messrs. Chandler, Whitman and Goode.

The Rochester (N. Y.) telephone subscribers' organization has decided to organize a company under the general telegraph law to operate in seventeen counties of the State. The articles of incorporation were to be signed this week.

Thomas A. Edison is seriously ill of pleurisy at his home in Llewellyn Park, Orange, N. J. Considerable anxiety is expressed about his condition by his many friends and all who know the great inventor. His wife is constantly with him.

The Boston *Herald* makes this suggestion of an efficient method of filling up a subscription list: Mr. Bell, of telephone fame, has contributed $1,000 to the fund for Mrs. Logan. Now if all the other fellows who claim to have originally discovered the art of transmitting articulate sound by wire would only chip in an equal amount, the subscription list would be chock full.

The interference case of Buell versus Martin, involving the broad claim to the method of distinguishing between a true and a false alarm in a closed circuit thermostatic fire alarm system, which has been before the U. S. Patent Office for some time past, was settled finally December 30th ult. by the Commissioner of Patents awarding priority of invention to Mr. Martin, of Martin & Wilson, Boston.

Mr. H. M. Cleveland, vice-president of the National Electric Light Association, has formed a co-partnership with Mr R. H. Whitney, for the purpose of transacting a banking and brokerage business, at No. 7 Exchange Place, Boston. Mr. Cleveland will receive the best wishes of his many electrical friends, among whom we desire to be classed, all of whom are assured of a hearty welcome on calling on Mr. Banker Cleveland.

It will interest our readers that Dr. Werner Siemens, of Berlin, the great electrician and inventor, attained his seventieth birthday on the Dec. 13th. Some forty years ago, Dr. Siemens was an active artillery officer, going through the Danish campaign; but in 1849 he laid aside the military coat, and became an engineer, founding in company with Herr Halske, the world-renowned works in Berlin. It is not too much to say that the manufactory in Charlottenstrasse has helped, in some way or other, in almost all the great discoveries made of late years in the province of electricity.

Go to the next electric light convention. It will, we are now convinced, be the strongest and most interesting meeting of the association—a natural sequence of the efforts of its earnest managers, and the great advance and spread of the electric lighting industry. We are pleased to learn that there is a growing interest taken in this association and its work, by the sub-companies all over the country, and that the attendance in this respect will be unusually large. There is not a company operating a plant but what should be represented at every meeting of the association, and the advantages will be found to outweigh many times any expense or loss of time attendance on these conventions may compel. The idea of having plans of various electric light plants and stations on exhibition is, we think, a most admirable one, and should result, in the light of the experience of the past, in the presentation of a number of comprehensive and original designs.

One of the strongest and most striking of the many good things said at the last meeting of The Electric Club in this city, was the remark of Mr. Geo. W. Hebard, president of the United States Electric Light Company, in which, referring to the small amount of loss by fire caused by the electric light, shown in Mr. Beane's paper, he said: "This is more phenomenal when we consider that this period covers a time when this new industry has been passing through its earliest childhood, surrounded by all of the limitations attending a new thing with which the people at large are unfamiliar. Yet, notwithstanding the ignorance of the people who erect the circuits and the ignorance of the people who use the lights, we still have this phenomenal result—I think I may say it without hesitation—that in the five or six years since the first introduction of electric lighting in any commercial sense, there has not been a single instance where any conflagration of any extent has ever been attributed to the electric circuits. As has been properly said by our friend from Boston, (Mr. Frank Ridlon) electric fires are safe fires; they are quickly found and extinguished, and there is nothing in connection with electric circuits to feed the fire."

EXPERT TESTIMONY.

The applications of scientific principles to matters of commercial life connected with manufacturing or transportation give rise to a demand for an authoritative exposition of the exact measure of the application of such principles whenever any disputes as to value are involved. The patent system of this country is increasing and the amount of capital vested solely in the confidence of the value of these temporary monopolies granted by the Government is enormous, and scarcely to be estimated. With the growth of the patent system it has been necessary for the patent office to demand, with great precision of statement, the exact limits and nature of an invention, before the subject of granting a patent could be seriously considered.

Nevertheless, clashes of patents are inevitable, especially when the interests involved are considerable and the salient features upon which the matter turns, are, apart from the evidence of dates of invention, the testimony offered by experts skilled in the state of the art. Yet the status of such testimony is unknown to the law. On more than one occasion have we called attention to this matter, trusting to sow the seed which should prove the germ of a public opinion, which alone can rectify the matter.

In electricity alone questions will be brought to an issue before the courts in the immediate future, and the manner in which justice shall be meted out will be due to the clearness of the presentation of the exposition to the court of principles involved in the invention.

The State of Massachusetts elected as Governor, Oliver Ames, a manufacturer and financier of extended experience, and a man of affairs of great breadth of view. In his recent inaugural, said to be the most brief ever delivered in that ancient commonwealth, he found space to say under the head of

"EXPERT TESTIMONY."

"In connection with questions of legal procedure, I suggest that you consider what change, if any, may advantageously be made in the practice of the courts concerning expert testimony, so called, whereby the difficulties and objections now attending the use of this kind of testimony may be lessened or removed."

Sensible advice which may be said like the title page of a rare old almanac published at Boston nearly a century ago, "calculated for the latitude of Boston, but good for the rest of the United States."

ELECTRICITY ON THE STREET RAILWAYS OF BOSTON.

It has been well known for some time that Mr. C. A. Richards, the president of the Metropolitan Horse R.R., of Boston, has been giving careful attention to some of the later methods of applying electricity to street cars by means of secondary batteries, but it was hardly expected that he was prepared to advocate such a startling innovation in his annual report as the substitution of electric motive-power on a railway corporation which now owns 4,000 horses.

It will be observed that the portion of the report treating of this subject does not accept the method of electric connection with a central station, but, instead of attempting the use of such large amounts of electrical energy as has hitherto proved to be impracticable, it very sensibly advocates its use within limits which can be easily controlled. The portion of the report treating on this subject is as follows:

The subject of other power for propelling our cars has received much attention, and been the cause for discussion at most all of our meetings during the year. The two methods claiming most attention being the cable and the electric power.

In case of cable power, it has seemed to be a subject requiring the most careful investigation. The one obstacle presenting itself is the peculiar topography of our city and the extreme narrowness and crowded condition of our streets.

Engineers and experts with cable experience have pronounced the use of cable power in Boston of very doubtful expediency, and, at the most favorable view, an experiment of great cost, with the majority of the chances against its success. It would cost hundreds of thousands of dollars to prepare our roadbed, and to put in the conduits for cable purposes, which would all be lost if the experiment failed. Power-houses, with costly engines and machinery, would have to be acquired; and your directors, while fully alive to the importance of a change in our motive power, have hesitated before embarking upon this kind of enterprise. The president has visited the most of the cities of this country where cable-power is used, and carefully examined into the cost and practical working of the whole system, and he has reported that he cannot recommend his company to make such an enormous expenditure upon such an uncertain basis.

The other and most important subject is electr city as a motive power. Attractive at once, as it demands in one way but a small outlay upon our road-bed, and in another none whatever. There are now a number of electric roads in operation in this country, and they are working with a very fair degree of success, the one obstacle toward their adoption in our streets being the source from which the electric motors take their supply. This is done on these roads in different ways, either from a wire stretched by the roadside overhead in poles, or by the substitution of a third rail laid between the others, and the electric current passed over the overhead wire, or through the third rail, both systems being entirely impracticable for us. The third and coming method needs no alteration or expenditure upon our tracks or road-bed whatever, it being the accumulator or storage battery system. This is a plan by which the force or power is placed in boxes or accumulators, and then placed in our cars, or in a separate motor. But one power house with large engines and dynamos would be required. Positive success has been proved in Europe and this country with this plan, and experiments are now being made as to the best kind of motor, by parties who will soon be able to equip ours or any other road with either separate motors or fit our cars with motors. The whole plan certainly looks very well, and if successful, of which there seems to be scarcely a doubt, a new and very promising career of prosperity for our road will open at once.

CHICAGO ELECTRICAL NEWS.

An interviewer the other day, after talking with Prof. Barrett about fires and fire ways, said, "when the Professor looks out into the office where his assistants, Dave Hyland and Johnnie Fitzpatrick are keeping tally on half-dozen fires in different parts of the city, he often wonders to himself how they do it."

"It was in 1863," said Prof. Barrett the other day, "that I first went on watch in the tower. It was on top of the old court house on Clark street, and was about one hundred and fifty feet high from the ground, I guess. Our room was near the top, and was walled around with glass, so that the whole city could be seen. Above us was the belfry, and we used to ring the bell that was cut up into so many relics of the big fire, by means of a lever. The city then was divided into six districts. The first was east of Clark street and south indefinitely; the second was west of Clark street and east of the river; the third was south of Madison street on the west side; the fourth was north of Madison street; the fifth was west of Clark street on the north side, and the sixth between Clark street and the lake.

"When a fire was discovered the watchman would first strike eight on the bell and then follow with the number of the district in which he thought the blaze was located. All the engines were supposed to pass the court house on their way to a fire, and as they passed the drivers would look up toward the top of the tower where the watchman displayed a red flag pointed in the direction of the fire. You would be surprised to know how accurate our alarms were. We very seldom sent an engine to the wrong location. Of course the city was very small then, and we knew and could see nearly every house. Nevertheless, it required a pretty sharp eye to see where a fire was on a dark, cloudy night, especially during the winters, when the frost coated the glass. We had a rustling fire department though. It was as good as any we have ever had.

"I stayed in the tower till the fire-alarm telegraph system was adopted in 1865, when I was put in the office. When I went on there were two brothers there named Joyce, but they left and other men took their places. The job was often given to old firemen. One of these afforded fun for the whole town for

a week. He napped at his post during the evening, and when he awoke the sky was all aglare in the east, and he thought Wabash avenue was burning. He turned in an alarm right away, and all the men went down on the lake shore looking for fire. They found nothing except that the moon had risen and was still looking red and hazy through the fog. The moon fooled the watchman.

"After a time the city got too big for such a provincial system, and the smoke from the factories obscured our sight. Then the fire alarm telegraph was introduced. Old U. P. Harrison was the chief engineer who appointed me."

Prof. Barrett reported to the City Council at its first meeting of the new year, that it would cost $56,000 to light the river and the bridges and viaducts south to Twenty-second street. The report was referred to the Committee on Fire and Water.

The new building of Marshall, Field & Co., to be occupied by their immense wholesale house, situated on Fifth avenue, Adams, Franklin and Quincy streets, and occupying one entire square, seven stories and a basement, is really three separate buildings, with fire walls between. Midway of the block on Quincy street, the site and building formerly occupied by the News Boys' Home—they have moved down on the south side, where in summer they will lose less time going to and from the lake—is to be converted into engine, boiler and dynamo rooms, with communication beneath the street by means of an archway, into the new structure.

The immense structure is to be lighted, of course, by electric lights In the competition for the contract for arc lights the Western Electric Company came in ahead, and are to furnish dynamo power for 180 lights. They will put in, as a beginning, 150 double, full power lamps.

In the other race, the Edison Company are winners. This contract calls for 500-lamp capacity; two 25-light dynamos. The lamps, 16 c. p., will be suspended from the ceiling by silk-covered flexible cords, and will, in the commencement, count up 400.

The Edison Company have also secured the contract for the Phœnix Building, corner of Clark and Jackson streets. The wiring will be kerite throughout, and the contract calls for 1,700 16 c. p. lamps.

Fairbanks, Morse & Co have recently installed an incandescent central station on the Westinghouse three-wire system at Beaver Dam, Wis. The street or overhead wiring, has capacity for 1,200 16 c. p. lamps. Machinery has been set for 500 lamps, and has been in operation since November 1st last. Inside wiring has been done for 800 lamps, and orders are on file for 250 additional, while work is being pushed as rapidly as possible. It is already evident that an increase in power capacity will be required, and the pole lines will need to be extended within the next two months.

The streets were partially illuminated by fifty lights recently, whereupon the Council at once ordered more to be put in. The people as well as the authorities are well pleased with the results.

At Oskaloosa, Iowa, the same firm has installed a 400-light Central Station, its entire capacity being subscribed for at once. A similar state of affairs exists at Maquoketa, Iowa, where they recently put in a central plant of 300 capacity.

In addition to the above, isolated plants have been placed by F. M. & Co. for Kimberly, Clark & Co., and the Atlas Paper Company at Appleton, Wis., O. I. Newton, Sparta, Wis., N. Shaw & Co, Eau Claire, Wis., and Levi Dodge, at Delphi, Indiana.

The old lady down East who said that her new house was fitted up with electrical pronunciators and rheumatic tubes, has a relative in Chicago, who has expressed herself on the subject of electric lights. She says that "while the hallucination from the irridiscent lamps is very gratuitous to the eyes—in short, perfectly spangdangleous—the idea of putting a ton or so of dynamite under the house is rather dangersome. And then to think of the conductors runnin' through the perditions, even into the sleepin' departments—it's awful to contemplate. I'd rather go back to candles, and dip 'em myself."

CHICAGO, January 10, 1887.

BOSTON ELECTRICAL NEWS.

Tuesday afternoon a large party of gentlemen interested in gas and electrical interests visited under the leadership of Mr. Frank Ridlon, the enterprising town of Woburn, Mass., for the purpose of inspecting the new system for long distance incandescence lighting of the Sun Electric Company. The party on arrival at Woburn went at once to the factory of the Sun Company, where Mr. Slattery, the electrician of the company, explained the principles of his new system. Inductoria or induction coils are employed. At first rectangular sheets of iron magnetically and electrically insulated from each other, and so disposed that a hollow square is formed, the sides of which are wound with the copper insulated wire of the primary and secondary coils. The secondary coil is wound on nearest the iron, and is of large size and low resistance. To this the lamps are connected in multiple arc. Outside, the primary coil of many turns of fine wire is wound, and in this an alternating current circulates, inducing currents in the secondary coil proportional to the number of turns of wire in that coil, and as there are comparative few turns in the secondary coil the electromotive force or electrical pressure of the current induced in it is low, and consequently harmless. The inductorium or transformer just described is placed in multiple arc with other transformers on the same leads or on separate leads as the case may require. A current of 1,000 watts is sufficient to maintain twenty 16 candle-power lamps at high incandescence. In the primary circuit there flows (when lights are burning in the secondary circuit) a current of one ampere with an electrical pressure of 1,000 volts. A No. 12 iron wire in many cases being sufficient to convey this current from the dynamo to the transformer, one ampere at 1,000 volts is equivalent to 20 amperes at 50 volts pressure. There is no connection between the primary and secondary coils. To show the economy of the system there was placed in the primary circuit an incandescent lamp, and as the lamps in the secondary circuit were turned on or off the current in the primary circuit increased or diminished in proportion. For as lights were turned off the lamp in the primary circuit grew dim; while three were burning in the secondary circuit the indicator lamp was not even red. The party now proceeded to Mr. Slattery's home. The leads from the factory about 2,000 feet in length are No. 12 iron telegraph wire. In the kitchen hanging on the nail is the transformer of a capacity for 20 lights. The lamps were tastefully arranged, the rooms were thoroughly and pleasantly lighted. The transformer used in this case is of the type which the Sun Company are sending out with the plants they are installing, in which the core is composed of a continuous ring of fine iron wire insulated by the formation in its surface of an oxide. The dynamo room of the factory was next visited. The alternate current dynamo supplied by the Sun Company is of the multiple pole type, the armature containing no iron. A small continuous current machine is used as an exciter.

The platform at the depot and a number of houses have been lighted for a considerable period, to prove the capabilities and flexibility of the system. There is only 10 per cent. drop in the conductors and no loss in the transformation. Though the primary coils are always connected with the mains, no current flows through the wire if the secondary circuit be open. The counter electromotive force caused by self-induction then rises to an amount so nearly equal to the difference of potential of the mains that commercially speaking no current flows. Mains in this system may be 3½ to 4 miles long, and a No. 6 Stubb's gauge copper wire will convey enough every ——— to operate 400 lamps; circuits to reach Stoneham and Wakefield will be put up at once. The Boston Electric Lighting Company expect to install at the Ferdinand street station an apparatus for operating the Sun transformers in various parts of the city.

Among the large numbers present were: Treas. Greenough, Boston Gas Company; Supt. Neal, Charlestown Gas Company; Gen. Man. Rogers, Roxbury Gas Company; Henry Bigelow, Clinton Gas Company; Treas. Monks, South Boston Gas Company; Mr. Shippey, and others of the Milford Electric Light and Power Company.

W. Elliot Tette, President of Dehany, Hyde Park and Marblehead Gas Company; Frank Ridlon, agent Brush-Swan Electric Company; S. S. Sias, Secretary Boston Electric Lighting Company; F. A. Gilbert, President Boston Electric Light Company; P. Fahey, Gen. Supt. Boston Electric Light Company; F. M. Gilley, ELECTRICAL REVIEW, and others.

My boy dotes on electricity. He's fond of the words of that science. Now, a few days ago I asked him to shovel off the side walk, and he promptly replied: "I shunt—I think that a series matter."

Telegraph and telephone wires have thus far this winter escaped destruction from sleet storms. The extension of the underground service in Boston is perhaps as successful.

An engineer of wide experience in steam engineering, remarked a few days ago that we are all wrong in the system of installing electric plants. So much of the motive-power of a station as is required for a few hours only per day may be made up of small engines requiring three to four pounds of coal per hour per horse-power. Such portion of the motive power as is in use for six hours or more per day should be made up of compound condensing engines, giving a horse-power for two or less pounds of coal per hour. For short hours of service the interest on an expensive and economical steam plant is more than the saving in fuel over the ordinary engine. For example a station of 2,000 horse-power furnishing current for light and power purposes may have a steam plant of the most economical pattern of 1,000 horse-power, as that amount of power will be required over six hours per day, the remaining 1,000 horse-power may be divided among small engines of the most approved simple non-condensing engines.

In many instances the service of a long stroke engine might be much improved in running dynamos if heavy fly-wheels be placed on the counter shafts. Where such plans have been tried remarkably steady motion has been obtained. In a few cases fly-wheels have been placed on the armature shaft of a dynamo with a great improvement in the steadiness of the lights.

The square in Medford will soon be lighted by electricity.

Incandescent lights are used in portions of the Globe and Park Theatres. The success of the light in the Bijou Theatre has led the proprietors of the first mentioned houses of amusement to ask the Central Station to furnish them with lights. It is said to be undesirable to supply theatres from Central Stations for the lights are used for a few minutes at a time and the sudden variations of load caused by the throwing on or off of a large number of lights disturbs the rest of the circuit.

Boston, Mass., January 11, 1887.

The electric railway at Los Angeles, Cal., has been started, and the city has the credit of having the first electric road west of the Rocky Mountains. The first trial, made last week, proved satisfactory, so far as showing the practicability of electric roads and their advantage over other systems.

A fire on Tuesday last in the upper story of the house owned by Prof. Alexander Graham Bell in Washington, caused a loss of $50,000. The origin of the fire is unknown, but it is supposed that it began in the laboratory, which was located in the attic story, and which contained a number of Prof. Bell's electrical appliances. The library, containing about 5,000 volumes, principally of a scientific character, was almost totally destroyed. The insurance is supposed to be about $25,000.

To make shellac varnish, the shellac should be just covered with alcohol or methylated spirit, and left for twenty-four hours, with occasional shaking. The liquid portion is poured off, and the undissolved treated with a little more spirit.

BICHROMATE BATTERY.—Any pot or jar with a zinc and a carbon plate in it (retort carbon will do, with clamp binding screws, screwed hard on to it, or the end copper-plated and the binding screws soldered to the copper, and the latter painted with Brunswick black or paraffine wax) within the jar a solution of 3 parts bichromate, 1 part sulphuric acid, and 6.6 parts water. A very small battery, with only a few square inches of acting carbon, will do for a medical coil.

Glass porcelain, and other metals can be soldered by an alloy made as follows: Copper dust, obtained by precipitation from a solution of the sulphate by means of zinc, is put in a cast-iron or porcelain-lined mortar and mixed with strong sulphuric acid, specific gravity 1.85. From 20 to 30 or 36 parts of the dust are taken, according to the hardness desired. To the cake formed of acid and copper there is added, under constant stirring, 70 parts of mercury. When well mixed, the amalgam is carefully rinsed with warm water to remove all the acid, and then set aside to cool. In ten or twelve hours it is hard enough to scratch tin. When required for use, it is to be heated so hot that, when worked over and brazed in a mortar, it becomes as soft as wax. In this ductile form it can be spread on any surface, to which it adheres with great tenacity when it gets cold and hard. This alloy is intended to be used to solder such articles as will not bear high temperature.

QUERIES AND ANSWERS.

To the Editor of Electrical Review:

Will the ELECTRICAL REVIEW please tell me if there exists such a machine as a dynamo in which the motive power is electricity? If so, where a description of such machine can be obtained? Can you furnish description? C. OSWALD ROURKE,

213 Tenth street, South Brooklyn.

There is no dynamo in which the motive power is electricity, although there are some who would make the public believe so—to sell stock—and unless our present knowledge of science is wrong, such a machine cannot be made, *i. e.*, a dynamo run by a motor taking a part of the current generated by the dynamo. F. M. G.

To the Editor of Electrical Review:

In your answers to inquiries of subscribers please give us some information in reference to "spark coils" used in electric gas lighting.

We understand an induction coil to be dangerous.

Can a spark coil such as used be made so as to be dangerous?

(1.) Give size of core and size of wire used on 8 or 10 inch coil, and quantity and size of wire used for winding.

(2) Is the waxed annunciator wire as good to wind coils with as cotton wrapped and not waxed? X. X.

(1.) For core use No. 18 iron wire. The diameter should be about ¾ in. Wind on this about 3 lbs. of No. 14 or 16 cotton covered wire, and connect with the ends of this wire so that it may be in the circuit.

(2.) Waxed annunciator wire is as good as cotton covered without paraffine. Annunciator is usually No. 18, which will answer perfectly instead of a coarser, will unless you wish to use automatic burners.

A shock from such a coil is unpleasant but harmless. F. M. G.

Telephonic News

⁂ The Kansas City telephone exchange has gained 500 subscribers during the past year, making a total of 1,750 subscribers. A new multiple switchboard has been ordered. The manager, Mr. D. B. Macquarrie, one of the best construction men in the country, has resigned, and Mr. J. W. Ebert is now acting manager.

⁂ A wire stretcher has been patented by Mr. Andrew B. Graham, of Burleson, Tex. This is a machine with a shaft carrying a movable pinion, racks with clamping jaws, pawls, etc., whereby the parted ends of a broken strand of wire may be brought together to be bound, being designed for use in mending wire fences, telegraph wires, and for similar purposes.

⁂ The management of the B. & O. Telegraph Company instituted another cut in tolls on the 1st—a uniform rate of 20 cents for ten words, with one cent. for each additional word, being ordered to Marietta, Middletown and Philadelphia, in Pennsylvania, Baltimore, Washington and various points in New York, New Jersey, Connecticut, Rhode Island and Massachusetts.

⁂ By a decision of Judge Ramsey in the Supreme Court, handed down January 3, in the case of the Bell Telephone Company against the city of Rochester, an action brought to restrain the Executive Board from interfering with a telephone pole, the temporary injunction was vacated, and an application for a permanent injunction was denied, with costs. This is supposed to establish the fact that the city has the right to order the poles of the company out of its streets.

⁂ A telegraph transmitter has been patented by Mr. James W. Shryock, of Trinidad, Col. It consists of a series of sliding bars or rotating disks carrying transverse ribs corresponding in width to the dots and dashes of characters, a contact spring moved by the ribs, and making contacts corresponding in duration with their width, combined with a bar of a circuit opener and closer, and with other novel features to transmit electric signals and characters by a single motion of the finger for each character.

⁂ The many friends of those masters of the telephonic art, Messrs. O. E Madden, W. D. Sargent, H. L Storke, and A. B. Uline, will wish them a merry voyage and pleasant sojourn in Nassau, among the Bahamas, for which point they sail on the 20th of the month. These gentlemen are all stalwart toilers in the telephone field and have well earned a pleasant respite from labor. The REVIEW tenders to them its wishes for a joyful trip, unvexed by subscribers complaints or legislative ignorance.

⁂ The Central Union Telephone Company has paid out $10,000 in improving and extending its lines at Quincy, Ill. One hundred and twenty-five new telephones have been added to the system during the year, and the telephone is now in general use throughout the city. The service there is exceptionally efficient, and the management is all that could be desired. Early in the spring the wires in the central portion of the city will be cabled, doing away with the high poles and roof towers, as 100 wires will be gathered in a single cable.

⁂ A five cent nickel costs Uncle Samuel 1¼ cents, and if the treasury department ever should reduce the present circulation of that handy little coin, it will be seen that there have been a great many manufacturers. The profit is large enough to enable the counterfeiter to produce a genuine coin, as far as value and material is concerned. But what are we to think of the wretch who descends to that species of petty villany, and then stamps his product with: "In God we trust?"

And the cent and two cent bronze coins are in the same category. The metal costs twenty-four cents a pound, and a pound will make 160 one cent pieces.

A Reporter's Visit to the Boston Telephone Exchange.

Anyone who has often used the telephone must have had occasion to be impressed with the mysteriousness, the sense of material non-existence of that part of the machine and its belongings, that lies beyond one's own instrument, and that of the person at the other end, whom one is talking to, says a writer in the Boston *Post*. My own material existence I am reasonably assured of. I can imagine my friend at the other end of the line. But between us two there is an airy nowhere, inhabited by voices and nothing else—Helloland, I should call it. The vocal inhabitants of this strange region have an amazing vanishing quality. Even while you are talking casually with one or another of them you may become aware that you have been unaccountably "cut off;" and if you become impatient, and raise your voice in earnest demand or protest, the more you bellow, the more you become aware that you are idiotically shouting yourself black in the face against a mere inanimate box stuck against the wall. Nothing else than the supremest invention of the nineteenth century could make man so supremely ridiculous as he is when he is shouting objurgations into a telephone transmitter that isn't "connected." The consciousness of such an experience produces in sensitive men, I am sure, a sensation of nervous shock, some akin to seasickness. And sometimes, when you are talking blithely enough through your central office intermediary, you hear the confused murmur of a hundred voices. You catch more expressions from private conversations than your nerves can transmit to the central office of your brain; and if you are imaginative you may undergo, as I have, a feeling as if you had a hundred astral bodies that were guiltily listening at as many keyholes. The central office is not like any other business establishment whatsoever. The telephone seems to you to have no visible agency. If you have business with the company, you telephone it. Your applications and complaints go over the wire to that one impersonal, impalpable voice.

In the first place, there is something besides a voice at the central office. I beheld, as the door was opened, twenty comely young women sitting in a long row, in easy arm chairs, before tables with endless apparatus before them. That was the first fact that I grasped. The next one was that those girls were not shouting at all. There was a low, indistinct murmur, and that was all. As I approached nearer I could hear, in tones not much above a whisper, the ever monotonous "Hello! hello!" "Ye-es!" "Good-bye!" but one clear voice, in a good speaking tone might have been heard plainly across that whole room above all the business of making the connections for 2,000 people. Every girl had strapped upon her head, or rather held there by its own grip, an apparatus composed of crossed steel bands, which held a small telephone receiver to her ear. Before her, dangling by a long wire in just such position as to hang exactly in front of her mouth, was the transmitter. Each girl leaned back in a comfortable attitude, and seemed entirely cool and totally unconcerned, while both of her hands were occupied in inserting wires with metal plugs at their ends into certain holes before her, and pulling them out again. There were rows upon rows of these little apertures, and every one of them represented somebody's telephone number. Each girl takes care of a limited number of calls, which are signalled to her by the dropping of a little metallic tablet with the number of the caller's instrument upon it; but she has within her reach, in those little apertures that I have mentioned, every one of the telephone numbers within the radius of the exchange.

"These seem to be young women of excellent physique," I said to the superintendent.

"We insist upon that," said he: "we have found that girls of good physique, healthy young women, are much less liable to irritation and impatience, much less likely to 'get rattled,' than those who are a little weak or ill. It is not that the work wears upon them, so that only women of unusual physique can stand it, but that we must have operators who are likely to keep their tempers and maintain coolness of demeanor. Does it deafen them? I have never known but one case of an operative's hearing being affected, and that might easily have been from some other cause. They do not seem to suffer much nervously, though there was one case of hysteria here last week. One of the girls—that one with the slender figure and dark hair near the end of the line—got confused and 'rattled,' as we call it, over a series of vexations, and asked to have a substitute placed in her chair. You see that we keep five substitutes in the room to relieve those who desire to be relieved at any time. Well, this young woman went into the girl's waiting-room and had an attack of hysteria there. Not infrequently something occurs on the line—somebody gets impatient and loses his temper—which troubles the girls. They generally go out into their room and have a good cry, and come back feeling better. They certainly seem to like the work, though the pay is only $7 a week. The hours are not long; they sit all day; they are relieved when it is needful, and the actual work seems to be agreeable to them."

There was a strumming sound under the superintendent's table. He held a telephone receiver to his ear, and talked through a movable transmitter on the table. "Certainly," he said in a low voice, "I will relieve you." He summoned a young woman from the window, and motioned her to take the chair of one of the operators. He had been talking with one of the girls, not 15 feet away, over the telephone! She could have spoken to him through the air by turning her head, but it would have made a little bit of noise and confusion in the room, and this modern Tower of Babel, this vocal sensorium of a whole city, is as quiet as a public library reading room. The substitute girl took the other's place, and two "calls" came tumbling down at the same instant, and somebody was undoubtedly vexed because he was not answered for an instant while she was making the other connections. But it takes but an instant.

"We like to have people who have telephones come up here," said the superintendent; "it gives them an idea how the thing is done, and we notice that they seldom get impatient in the use of their telephones afterwards."

Certainly these girls were not trifling with their work. The superintendent, by merely putting an instrument to his ear, can hear every word that passes between an operator and the people with whom she talks; and that seems almost an unnecessary restraint. Vexation makes the work harder for the operator, and she avoids it. Women are found to be better operators than boys, though boys must be employed at night; and that is why the day service is better than that of the night.

The girls glanced at me as I walked by their desks with the passing curiosity of all women and all men, but their hellos went on just the same. I saw more than one genuinely pretty face. Helloland is not so ghostly after all!

Electric Photography.

Not long since were recorded some interesting experiments in which Mons. Ch. Zenger secured photographs in the darkness of a moonless night through the imperceptible phosphorescence of certain objects which had been brightly illuminated during the day. Mons. D. Tomassi has now described some remarkable effects under the euphonious name of "effluviography." By an exposure of a few minutes' duration, he has impressed upon a photographer's sensitive plate an image of an object through which a silent discharge of electricity was passing, this result being obtained even when care was taken to ensure perfect darkness, and with a current of too low tension to give any sign of light. The theory of the experimenter is that a body under electric influence emits "electric rays" analogous to the dark rays of the spectrum.

It Was Not a Sea Serpent.

The following lively account of the adventures of a telephone pole on Broadway, New York, will be appreciated by every man who ever undertook to pilot one of these 60 foot fellows along a crowded thoroughfare. Says the *Sun*:

The rumor that an amphibious sea serpent had escaped from the North River into Cortlandt street and swallowed a horse and wagon turned out to be exaggerated. The facts of the case are as follows: A sixty-foot telegraph pole, dirty and scarred that an imaginative person might have taken for a sea serpent with a frozen spine, was dragged through Cortlandt street by two spirited white horses. The pole was suspended under a two-wheeled truck, and the big end bounced and wobbled along the street as if it were endowed with the post-mortem life popularly attributed to dead serpents' tails. The driver of the white horses loudly notified everybody at Broadway that they had better look out, as he was going to take the erratic pole up that crowded thoroughfare. A man in a light wagon on the south side of Cortlandt street looked out just in time to see the big end of the awful pole swinging his way. He urged his horse westward too late to avoid the pole. It swept the wagon nearly twenty feet, and slammed it against the curbstone of Cortlandt street.

The pole director stopped the white horses, swung the big end of the pole northward and let the man in the light wagon get his vehicle out. Three policemen united the power of their lungs in warning car, track, wagon, and cab drivers to make way for the pole. For ten minutes it stretched diagonally across Broadway, causing an immense jam of vehicles. At last a space was cleared and the pole swung around parallel with Broadway. A dozen people jumped over it and saved themselves from fractured shins. It made another swing into Park row, scrapping a street car and scattering a score of pedestrians. Then it proceeded up town to its hole.

The police list of vehicles it upset and the people it killed and injured after leaving Park Row had not, up to an early hour been completed.

Mr. Finn Talks of the "Voltaic Battery"—A Possibility of the Future.

William Finn of the Western Union delivered the second of a series of lectures on "Voltaic Electricity" before the Buffalo Electrical Society last week, the particular subject selected being "The Voltaic Battery." This was described as an apparatus for generating electricity by means of chemical action; the amount of electrical energy developed being proportional to the quantity of zinc dissolved in the battery, just as the mechanical energy derived from the steam engine is proportional to the quantity of coal consumed in the furnace. The essential conditions for a simple voltaic cell were two unlike metals immersed in a mixture of acid and water. But such a combination did not admit of a steady flow of electricity in consequence of a secondary action set up in the battery, to which the name of "polarization" is given. This was due to the liberation of hydrogen gas upon one of the generating plates, which then acquires an opposite electrical condition to that ordinarily assumed, with the result of reducing the potential difference between them, and thus destroying or reducing the electro-motive force of the battery. This source of trouble is obviated more or less in such batteries as the Daniell, Grove, Electropoion, and other two-fluid batteries, by surrounding the negative element with a body which absorbs the gas before it can reach that point. Although "polarization" in the case of a "voltaic" battery was detrimental to its working, this very action, the lecturer remarked, was the prime cause of the energy derived from the "storage" battery, which was capable of developing the most powerful and constant currents, and which would sooner or later come from under the cloud which at present partly obscured it, to take its proper place by the side of other sources of electric power.

Mr. Finn here entered into a detailed description of the various batteries in general use, illustrating their chemical actions and properties by means of diagrams and experiments Speaking of the "Gravity" battery, so much employed in telegraphy, he said in point of utility it was the one best adapted to the requirements of the 'closed circuit" systems of this country, as it gives a steady current under all conditions, does not need particular attention, and its products are of commercial value. The particular kind of battery to be selected for any given service depended on the nature and amount of work to be done, and several instances were given illu trative of this point. A good battery should have a high electromotive force and a low internal resistance. When the internal resistance of a battery is high, the energy of the current is partly wasted in overcoming it, so that in all kinds of apparatus, electrical or mechanical, the resistance or friction should always be a minimum.

The electric energy of the battery is directly obtained by burning zinc in the battery. If it were equally possible to provide electric power from the direct consumption of coal, which is much cheaper (and there are those who consider such a thing as not at all improbable) there would be every reason for the belief that enough electricity might be generated and collected from the fires in our grates and furnaces to supplant the ordinary generators at present employed for the production of electric currents.

Mr. Frank Kitton will lecture on the simultaneous transmission of telegraphic and telephonic currents over a single wire, at the next meeting of the society.

Electrical Phenomena on a Mountain.

In confirmation of the observations of M. F. (*Science*, viii., p. 564) in relation to electrical phenomena on Lone Mountain, near Bozeman, I beg leave to call attention to the fact that more than twelve years ago Mr Franklin Rhoda, assistant topographer, in his "Report on the topography of the San Juan country" (*vide* F. V. Hayden's Report of U. S. geological and geographical survey of the territories, for the year 1874, pp. 456–458; also p. 461), gives a detailed and graphic account of similar electrical manifestations, experienced by Mr. A. D. Wilson and himself, at station No. 12, on one of the peaks of the San Juan Mountains, in August, 1874, at an altitude of 13,967 feet above the level of the sea.

An interesting and significant circumstance recorded by Mr. Rhoda, was the fact that there was a sudden and instantaneous cessation of the distressing electrical manifestations whenever a stroke of lightning took place, to be speedily renewed by the returning tension of the electricity. He says: "The sharp points of the hundred stones about us each emitted a continuous sound, while the instrument outsang everything else, and, even at this high elevation, could be heard distinctly at the distance of fifty yards. The points of the angular stones being of different degrees of sharpness, each produced a sound peculiar to itself. The general effect of all was as if a heavy breeze were blowing across the mountain. The air was quite still, so that the wind could have played no part in this strange natural concert; nor was the intervention of a mythological Orpheus necessary to give to these trachytic stones a voice"—*John Le Conte, of Berkeley, Cal., in Science.*

A Chat Along 6,000 Miles of Wire.

The Baltimore and Ohio Telegraph Company comes to the front with the longest telegraph circuit on record, the New Orleans office exchanging greetings with New Westminster, B. C., over 6,000 miles of wire. Over this 6,000 miles of wire Operator O'Leary exchanged Christmas greetings with the New Westminster operator, and whiled away a few minutes in telling that lightning pounder how pleasant it was to spend the holidays in the land of perpetual summer, instead of perpetual winter.—*N. O. States.*

Graphic Description of the Chicago Fire Alarm System.

In the Chicago Fire Alarm Office in the City Hall is found a piece of apparatus not described in any electrical catalogue. It might be called a fire engine switchboard. It is of the plug variety of board, made of white oak and filled with irregularly placed holes with plugs. It has been called a chessboard. There are but a few men in all this great city who can or ever do play upon this peculiar board, and everything must be in perfect accord; that is, every circumstance must be perfect, or no game would ever be played upon it.

It is necessary there should be a fire. There is a second alarm necessary. The player must be a marshal of the fire army of the city. Then the game may be played. The player, his eye fixed upon an orange-hued map alongside the board, when there has been an alarm, figures out the locality by hunting a numbered pimple on the map. Certain engines have responded, and their houses are vacant. Now the game commences. The plugs, representing the engines, are pulled, and an empty hole shows an empty house. A bell rattles on a circuit which runs through the district where the fire is, and a telegram from the chief orders a second alarm sounded. Certain engines which before had only hitched and stood waiting, now dash from the opening door and rush like mad to the fire. Corresponding plugs are pulled, showing more empty houses. A void is made in a thickly settled portion of the city, and the void is to be filled. Engines outside these vacated portions are ordered in. It is as if one corps of an army had been ordered to active duty, and a second had occupied their camp. That is exactly what it is. The marshals are generals of the army—Marshal Swenie is commander-in-chief. The general who is playing the little game on the plug board says to the operator: "Send thirty-four to thirty-one's house." The operator calls - - - - - - and adds - - - - - - - which means "answer on the telephone," and the captain receives his orders to move down and occupy the vacated quarters. Other engines are ordered in. Another alarm, perhaps, brings 34 to the front of battle, and a machine still further away may be ordered down. If the fire is a "rager," and hard to control, still further orders from the "headquarters in the saddle," may order individual apparatus to the front. The little game of chess is as complicated by this time as the most difficult Morphy ever tackled, albeit it is somewhat different—but in its results far more important; 536 boxes have the power to open up a game on the mysterious little board—the little campaign map. The army commanded by General-in-Chief Swenie has a numerical roll of men and officers amounting to about 470 individuals. Where a military command is made up of horse, foot, and artillery, the fire army is made up of engine companies, hook and ladder companies, chemical engine companies. The department has also a navy contingent. The fire boat Geyser for river work lies in wait at the junction of one of the west side streets and the south branch, ready for duty when an alarm comes from a point within the reach of this naval adjunct. There will be another of these soon. Then there is a skirmish company beyond the city proper, which combines a hose cart and a chemical engine and does duty at Lawndale. There is also a sort of high range engine of attack which has no parallel in military. A species of giant—helpless in itself, but powerful with the aid of other engines, almost to create a second flood. This is a water tower with a horizontal delivery, which is raised to a little above the level of a fire in the upper floor, and delivers its "hot shot" of cold water in perfect torrents. The sapper and miner division of the army is composed of experts who handle this and the extension ladders.

The battle ground of the department covers over thirty-seven square miles, and the distance between the extreme north and south stations is about seven miles.

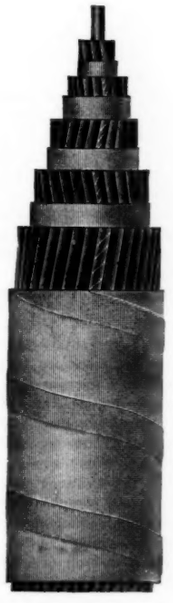
Every house has a copy of a printed running card, which shows what portion of the army and what generals will attend the fire, and excuse for failure must be extremely potent to prevent punishment. Chief Swenie and his first assistant, Marshal Musham, are both severe, but conscientious disciplinarians, and no partiality has ever been charged against either.

And all this huge army, commanded by one master mind, would be comparatively worthless but for the part electricity plays as chief aid-de-camp.

The Okonite Cables.

The cut on this page represents the new 91 conductor telegraph cable of the Okonite Company, which is being extensively used by the Western Union and other companies. The Okonite insulating material is very tough and elastic. It does not become soft and plastic at a high temperature, or hard and brittle at a low temperature, and consequently it is less liable to mechanical injury in handling, during the extreme cold of winter and the heat of summer.

The Okonite Company state that they are able to make a splice that has as good insulating properties as any other part of the wire or cable, without increasing the diameter to any noticeable extent; the size of the wire or cable offers no impediment to the use of this method, and as splices have constantly been a great source of annoyance in underground work to all manufacturers, their improvements in this direction will be appreciated.



OKONITE 91 CONDUCTOR CABLE.

Welding by Electricity.

A Boston exchange says: "In the issue of Dec. 18th, in the article describing Prof. Elihu Thomson's process of welding by electricity, the statement was erroneously made through misunderstanding that Prof. Thomson happened upon the discovery recently in the course of his experiments with electric lighting apparatus. The interesting fact is (and Prof. Thomson is entitled to full credit for a process which promises to become of the greatest practical importance) that the process was carefully thought out years ago and not discovered accidentally. Neither has it any connection with the important services which he has rendered in the field of electric lighting, but is entirely an independent matter. Those of our readers who overlooked the article mentioned will do well to refer to it, bearing in mind the corrections now made, as it is worthy of even more attention than it has received."

TELEGRAPHIC

.... The excellent quality of the work done by the American Electrical Works of Providence, R. I., is universally acknowledged, and the gentleman who designs their annual calendars is possessed of rare and exquisite taste. The calendar for 1887 is a work of art.

.... The new electric fire alarm proposed for Norfolk, Va., which it is thought the council will adopt, sends in the alarm to the engine house, police headquarters, rings the bell and opens the stable door, so that all the driver has to do is to get in his seat and go, the front doors being opened at the same time that the harness is dropped.

.... Messrs. Partrick & Carter's catalogue and price-list for 1887 is bountifully illustrated, and covers the field of electrical supplies most thoroughly. A view of their extensive salesrooms and works at 114 South Second Street, Philadelphia, is given on the cover. The business of this company is constantly increasing, and their standing in the electrical field is of the best.

.... In repairing the government telegraph cable which crosses Vineyard Sound from a point east of Tarpaulin Cove, Naushon to Cedar Tree Neck, Martha's Vineyard, it is found that it had been chopped off after being subjected to a great strain. It was probably raised on an anchor fluke and with the tidal current running strongly, so that the cable held the vessel nearly stationary until it was cut. There were several marks of an axe on the cable near the break, which is two-thirds the way across from Naushon. When it was laid, the shore ends were placed in trenches from below low-water mark to where the land wires were joined, but the cable had been pulled so forcibly that the Naushon end was broken from the wire, and the cable had been dragged out from under the stones and gravel that covered it into deep water.

.... Frederick Davies, superintendent of the Central and South American Telegraph Company at Lima, Peru, died in this city last week. He had been suffering from a complication of diseases for several months, and recently a vacation was given him to visit New York in the hope that the voyage and the change might be a benefit to him. He had been so weakened by his illness that he was unable to withstand the extreme change and he died soon after his arrival. Mr. Davies had been in the employ of the Central and South American Telegraph Company since its lines were opened in 1881. He had served previously in the Anglo and the Eastern telegraph companies, and was well known in Europe as a skillful electrician and telegraph manager. He was held in high esteem in the companies with which he had been connected.

.... Mr. Sandford Fleming has received cable information that a Pacific cable company has been formed in London under the name and title of "The Pacific Telegraph Company, Limited," with a capital of £2,000,000 sterling, in £10 shares, for the purpose of establishing, maintaining and working telegraphic and other communications between Australia, New Zealand and other places in the Pacific Ocean, Africa and America. The articles of incorporation were registered in London within the present month. A subsidy of £50,000 per annum is expected from the Home Government, and it is estimated that the various colonial governments will co-operate. It will be seen that the company, which is composed of the following, is a strong one: Lord Milton, Sir J. P. Corry, M. P.; Sir Daniel Cooper, Bart.; Lord Folkestone, Hugh G. Reid, Sir Alfred Slade, Bart.; J. H. Heaton, M. P; Hon. E. M. Young, Sir Donald A. Smith, Sandford Fleming, Sir Samuel Wilson, E. G. Finch Hutton, Capt. Ed. Ward Palliser, Randolph C. Want, Sir W. J. Clark, P. Perkins and Sir George Coote. The company are now awaiting replies from the various Colonial governments before commencing operations.

ELECTRICAL AND SCIENTIFIC

* * The Lane & Bodley Company, of Cincinnati, have been awarded the contract for a pair 24x60 Corliss engines, four boilers, cable driving and tension machinery, a complete plant for two cables for the Mt. Auburn Cable Railroad of that city.

* * The Ries Electric Railway Manufacturing Company has been organized under the laws of Maine for the purpose of equipping electric railways and manufacturing and dealing in inventions, materials, appliances and apparatus that may be used on or appertaining to electric railways. Following are the officers: President, Robert F. Straine; treasurer, H. H. Honore, Jr.; directors, Robert F. Straine, H. H. Honore, Philip T. Nickerson. Capital stock, $1,000,000.

* * An American correspondent in an English paper thinks there is a big boom ahead in accumulators. He writes: "Since Mr. Vail left the American Bell Telephone Company a year ago, his movements have been wrapped in some mystery. The secret is now out. Mr. Vail has gone into the accumulator business with the determination to make of it a still greater concern than ever the telephone has been. He and his friends have acquired the exclusive rights in the States of the patents for accumulators of Faure, Volckmar, Sellon, Swan, and many others. He has himself visited Europe two or three times during the year, and on one occasion took back with him a party of 20 electricians who had been specially trained in the manufacture of the Faure and Sellon accumulators at Millwall, London. It is stated that Mr. C. A. Faure has been engaged as chief of the experimental and laboratory department, and that Mr. W. W. Griscom will be engineer of the new factory started by Mr. Vail at Newark."

* * The decision of the Board of Arbitrators in the suits of Bent, Ingham and Downs against the Erie Telephone Company has been overruled by Judge Thompson of the Superior Court, on the grounds of the objection made by Hon. G. F. Richardson last week. It will be remembered that when the arbitrators announced their decision they neglected to state that "the claim of $1,000 made by William H. Bent against the company was a demand note overdue." This they attempted to do on the following day, but Gen. Butler objected, saying when the arbitrators made their first report they were discharged and could not organize again without the consent of both parties. Mr. Richardson, counsel for the plaintiff, then announced that he would claim before the court that the period of the arbitration was illegally extended. When the matter was submitted to the arbitrators it was agreed that the suits should be settled within six months. Owing to the numerous delays this was found impossible, and at the session of the arbitrators in July last, Mr. Richardson announced that he had made arrangements for a European trip and requested that the period of arbitration be extended in the interest of his clients. A document was drawn up containing a provision for this extension, and was signed by both parties to the suit. Through some oversight it was not sworn to before a justice of the peace, and the shrewd lawyers for the plaintiff availed themselves of that technicality. Judge Thompson took the matter under advisement, and as before stated, decided that the verdict of the arbitrators was illegal. Gen. Butler, J. N. Marshall, and William H. Anderson, who believe that the objection will not be sustained by the Supreme Court, have entered an appeal from Judge Thompson's decision. By advice of counsel, the Erie Company paid the fees of the arbitrators (about $4,300) and if Judge Thompson's decision should be sustained by the Supreme Court the defendants will be out that amount and the case will have to be tried again, if the plaintiffs care to push their claims for salary.

The Theory of Combustion of High Explosives.

Continued from Page Three.

the earth's atmosphere, and the explosions which have often been noticed are simply the effect of concussion against the aeriform anvil where the atmosphere is far less dense than it is here.

So it is in the case of a nitro-glycerine explosion, the rock strikes against the air with such velocity that it has the effect of a solid mass, and the rock is shattered.

Let us now reconsider the graphic symbol of nitro-glycerine (Fig. 1) and see if there is anything else peculiar about the arrangement of the atoms.

I have referred to the little dashes which are between the letters, which represent atoms, as bonds of chemical affinity. It is well-known to chemists that the integrity of every complex molecule depends on the multivalence of one or more of its atoms. Everyone knows that nitro-glycerine is made of nitric acid and common glycerine. The formula of nitric acid is $H\,N\,O_3$ or we may write it graphically

$$H - O - \left(M \begin{matrix} O \\ O \end{matrix}\right)$$

In the right hand portion of the nitro-glycerine molecule (Fig. 1) may be seen three nitric acid molecules, only their hydrogen atom has been replaced by a group of carbon and hydrogen atoms.

Much has been said of the electro-chemical theory first stated by Lavoisier and elaborated by the great Swedish chemist Berzelius, and we remember that according to this theory all the metals and metaloids can be arranged in a table so that every element is electro-positive to all that proceed it, and electro-negative to all that follow it. Let us once more write the symbol of nitric acid in the light of the electro-chemical theory, remembering that hydrogen is positive and (N O) is negative to oxygen, and that the oxygen atom acts very much like a bar magnet with one positive and one negative pole.

$$\overset{+}{H} - \overset{-}{O} - \overset{+}{(}\overset{-}{N}\,O_2\overset{)}{}$$

Here we see manifestations very similar to that polar force known as magnetism. In the nitro-glycerine molecule the positive atom of hydrogen is replaced by an atom of carbon which is positive on the side towards the negative side of the oxygen, and is negative towards the hydrogen atom. In this way the large and complicated molecule of nitro-glycerine is held together in something the same way as a number of small magnets, aggregated with their opposite poles touching each other would adhere until some extrinsic energy forced them outside of one another's polar attraction. Nor is the above statement of facts an isolated one. The molecule of every chemical compound is built up in precisely the same manner, the atoms displaying bonds of affinity which find the most startling analogy in magnetic force and magnetic induction, for atoms which possess but feeble polarity of their own can be made to show a strong polarity by their proximity to other radicles of greater power.

I have said it is a most striking analogy, and this paper would be indeed incomplete if I did not emphasize the fact that perhaps after all it is only an analogy. Atomic affinity is almost magnetic polarity. Perhaps in a better understanding of the facts we may sometime be able to demonstrate that such is actually the case.

I do not know how to state this better than by quoting again from the able investigator who has given this subject the earnest study of a lifetime. "Theories are means, not ends; but they are the appointed means by which man may raise himself above the low level of merely sensuous knowledge to heights where his intellectual eye ranges over a boundless prospect which it is the special privilege of the student to behold. What though his vision be not always clear, and his imagination fill the twilight with deceptive shapes which vanish as the light of knowledge dawns; yet to have enjoyed the intellectual elevation, is reward enough for all his devotion and all his toil."

ALLAN V. GARRATT.

Boston, Mass., Jan. 8.

Montaud's Accumulator.

The qualities which are chiefly required for an accumulator, are: 1st, the duration; 2d, the energy, or rather the rapidity of the production of electricity.

The lead plate must be perfectly homogeneous, and upon the lead peroxide should be formed instead of being applied upon the positive plate.

The plates must show neither bendings nor foldings to not be liable to get out of shape.

They must be sufficiently strong that the passage of the current does not cause any curving over them and so that, while supporting the layer of peroxide, their thickness be such as to furnish successive coatings of peroxide, under the influence of the current, during a long duration.

This thickness will have the advantage of permitting the straightening of the plate, should it have accidently assumed a curved shape, and there will then be no occasion for fearing to see the peroxide peeling off.

This leads to the doing away of the expression "weight," which simply corresponds to duration and can be replaced by the expression "surface."

The negative plate must be in the same conditions as the positive plate, should the shape only be considered. Only, it must be covered with a thick layer of pure lead, from which the capacity of the apparatus chiefly depends.

The pure lead, under the form of lead moss, and deposited by electrolysis or brought in by being formed, will require an energetic compressing to adhere to the sheet or body of lead, so as to constitute part of it to such an extent that it shall not be liable to get detached therefrom, should the plate even pass from a curved to a flat shape. In short, the two plates (positive and negative) must be perfectly homogeneous, one of smooth lead covered by the making of a layer of peroxide, the other one also of smooth lead covered with reduced lead.

The whole being without mixture of bodies or oxides mechanically deposited. To obtain the second condition above referred to, viz., the rapidity of "the furnishing of electricity," the following means are required:

1. As great a surface as possible.

The chemical actions taking place directly as the extent of opposite surfaces, it is clear that an accumulator of two square meters in surface will produce twice as much electricity as another of one square meter.

To this rapidity of production there corresponds a proportional rapidity of accumulating or of charging.

2. A most exactly even distance between each one of the plates, or rather of each one of the parts of said plates between themselves. The exactness in this case is the more necessary that the chemical actions take place in reverse ratio to the square of the distances and that one millimeter in the difference of distance apart between two points is sufficient to greatly affect the production of electricity. Let us add here that a correct proportion in the contacts, that is to say in the sundry connections between the plates, is not less necessary.

In other terms, should an accumulator be constructed so as to furnish 50 amperes, the contact must be capable of carrying a current of 50 amperes without getting heated, and ought not therefore offer a sensible resistance.

Lead, having a conductivity about twelve times smaller than pure copper, should have a section twelve times larger.

This is a very important precaution, one which too often is neglected.

3. Another essential condition is that all the solderings and all the plates be entirely immersed in the liquid, so that two strong terminals only rise up from the acidulated water to form the end connections. Yet these two rods should be coated with an insulating varnish, from their lowest part up to some height above the surface of the liquid. All of it in view to avoid loss by local action.

The liquid must be composed of 13 parts of water and of two parts of ordinary sulphuric acid at 66° Baumé. This proportion is necessary to hasten the reduction of the sulphate, which can only take place when the water is strongly acidulated. The proportion of acid should not be increased, otherwise the resistance of the liquid would also increase and thereby the internal resistance of the accumulator.

Any communication with the ground produces undesirable shunting, and as a result a considerable waste of energy.

The accumulators must therefore be absolutely insulated, and any communication with the ground is to be avoided.

These are about all the theoretical conditions which they must observe in practice in the present state of science when they want to construct a good accumulator.

The "Montaud" accumulator, shown in the figure, is of "Planté" kind, and the modifications introduced in Planté apparatus refer to the following points.

1. Rapid storage. 2. Great surface. 3. Manner of obtaining a symmetrical distance between the plates.

According to the inventor it presents many advantages.

1. Its duration (after six years, it is still in perfect state). 2. Its charging rapidity. 3. Its much greater production of electricity than in other systems for a given surface. 4. The easiness for manipulations and repairing without any especial knowledge being required. 5. Its small weight relatively to its production of electricity. 6. Its capacity, weight for weight, greater than in other systems in use. 7. Its strong build, which saves it from any accident which a disproportionate charge or discharge might tend to produce.

There are meanwhile a few details upon the composing of the plates.

The oxides of lead and litharge, more especially, are more or less soluble in concentrated alkaline solutions and heat helps much their dissolving.

Should they, then, plunge two lead electrodes in an alkaline-saturated bath, where they have dissolved litharge in excess, and should they send through it a current of proper tension and volume, there will be deposited upon the anode a layer of peroxide of lead, varying in thickness with the strength of the current, and it will be more or less rich in oxygen, according to the temperature of the bath.

Lead and cobalt are the only two metals the anode of which, in certain conditions which practice alone can indicate, instead of gradually melting, as happens in galvanoplasty, yet covered with a layer of peroxide, while the cathode, nevertheless, gets covered with a layer of reduced lead.

In this case the liquid of the bath furnishes the two deposits, while in galvanoplasty it is the anode which furnishes it to the cathode.

Preece's works have settled that to form a common accumulator they have to use a current of proper tension, the total strength of which must amount to about 1,000 hour-amperes.

With such a direction, they put in the baths a number of plates, sufficient to form an electrode surface representing 1.10 M. C.[2] about; they send through said electrodes a current having a tension corresponding to a regular production of 600 amperes, which amounts to 34 milli-amperes per square centimeter.

There are nine plates in each bath, eight of which only are useful.

The bath is traversed by a current of 600 amperes, giving 74.5 amperes per plate, which during half an hour represents 37.2 hour-amperes.

When they want to build up an accumulator of medium size, say of 4 square meters, containing twenty-nine plates, twenty-eight of which shall be useful, they will obtain an apparatus which, after getting out of the bath, shall have received twenty-eight times 37.2 hour-amperes, or 1,043 hour-amperes.

They will have, then, obtained in half an hour the conditions set down by Preec·, instead of requiring a much greater length of time.

All the principle of the manufacturing lies in "sending, in an efficacious manner, currents of great strength, thereby shortening in proportion the time of the building up of the plates."

Of two plates manufactured as just said, one becomes positive, and gets covered with a more or less thick coating of peroxide of lead. When it leaves the bath, it undergoes several manipulations, and several washings, after which it can be mounted with other, to make an accumulator ready to be charged, and to work.

The second plate, the negative one, has become covered with a thick layer of lead moss; it is carefully washed, kept in water, and not in contact with the air, and submitted to a very great pressure When it leaves the press, it looks like a common sheet of lead; the physical porosity has disappeared, but the chemical porosity remains entire. The last one, however, is the only interesting one in accumulators.

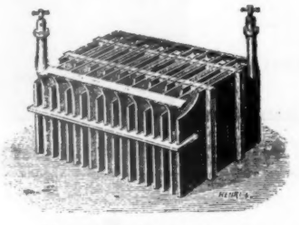
As soon as the negative plate has been treated in this manner it is ready to be mounted.

We could not end better this note than by quoting Dr. d'Arsonval's opinion, a well-known authority, and who has kindly given us the results of trials upon a type of accumulators such as we have just described.

"Montaud's accummulator," he reports, "is of "Planté" kind, it is to say a surface accummulator. Its mechanical construction seems to me well planned. The wood combings, which maintain the distance between the lead plates to prevent their mutual coming in contact, render the apparatus very strong.

"The lead plates thus form a whole which can be got out of the cell without trouble, which permits to inspect them from time to time.

"The building up process which is used is ingenious and rapid. To give to one square meter of lead a capacity of 20-hour amperes, one-quarter of an hour only is required. I



MONTAUD'S ACCUMULATOR.

have on several occasions witnessed this fact at the factory. This is a real advantage, for to obtain the same result with the "Planté" process months would be required, which would preclude the industrial use of the apparatus. This building up will allow of being furthermore simplified.

"Therefore, in a mechanical and manufacturing point of view, all seems to me well planned about it.

"Let us consider the electrical side of the question. I had, in my trials, more particularly in view the model No. 2, which offers a surface of two square meters and a weight of ten kilograms of lead.

"As soon as it has been built up, this apparatus, after having received a saturating charge, has shown to me a total capacity of 62-hour amperes. As in "Planté's" accumulator, this capacity will go on always increasing by use. A very simple modification, which I have indicated to the inventor, permits to at least treble at the beginning said capacity; experience has entirely confirmed this inference from theory.

"The normal rate for charging is 10 amperes per square meter. For discharging it is double, that is to say 40 amperes for the model in view.

"This apparatus has always given me, when discharged, 40 amperes when the tension was 1.85 volt, during one hour or one hour five minutes. The discharging must not go farther at this rate, which corresponds to 2-5 of the total capacity.

"The charging was done in two hours at the rate of 20 amperes without any sensible loss of electricity.

"Montaud's accumulator No. 2:

"Weight of lead..... 10 kilograms
"Total capacity.....62 hour-amperes
"Surface.....2 M. C.²
"Charge, at the rate of .....20 amperes
"Discharge, during 1 hour.40 amperes (1)

"(1) Since the time when these trials were made (September 8, 1885), the above figures have been replaced by the following ones:

"Weight of lead.....10 kilograms
"Total capacity.....100 hour amperes
"Surface..... 2 square meters
"Charge, at the rate of. 20 amperes
"Discharge, at the rate of. 40 amperes 68.5 hour amperes.

"The accumulator now considered could then store, if required, six hour amperes per kilogram of lead, and give back a current of four hour amperes per kilogram, without polarizing. But its chief quality lies in its long duration. The positive plates of "Planté" kind show little decay by working, and do not require to be replaced, as is the case with many other accumulators. Practically this is a valuable feature which greatly compensates for the small capacity of this kind of apparatus. Besides, in many cases, a great capacity is not necessary. For instance, in electric lighting, when accumulators are used as regulators, or so to say, as electrical fly wheels in respect to the machine. To my own point of view what is to be required from an accumulator, is:

"First, duration, and second, energy, or rather rapidity of surrendering electricity per kilogram. With this double end in view, the accumulators of "Planté" type, consequently Montaud's accumulator also, are very superior to accumulators' the plates of which have been built up in depth. As a matter of fact, the latter must have their positive plates changed after a constant service of some duration, and are unable to give back more than one ampere per kilogram, while accumulators of "Planté's" type last almost forever, and can give out five or six amperes per kilogram, according to the thickness of the lead plate.

"I am therefore of the opinion that Montaud's accumulator is a very practical one, being a great improvement upon "Planté's" and perfectly capable to now enter in competition with the other systems now in use."
—*La Lumiere Electrique.*

Splendid Showing of the Incandescent Electric Light of the Brush-Swan Company.

No better indication of the growing demand for the incandescent light need be given than the following partial list of installations recently made by the Brush-Swan Electric Company, of New England. The beautiful white light of the incandescent lamp of this company is particularly popular among the New England mills, and the company is crowded with orders. The following is the list, with the location and number of lamps:

Milford Electric Light and Power Co., Milford, Mass.	600
Morris Machine Works, Baldwinsville, N. Y.	100
Para Rubber Shoe Co., South Framingham, Mass.	950
Pelgram & Meyer, Boonton, N. J.	300
Russell & Irwin Mfg. Co, New Britain, Conn.	100
Remington Paper Co., Watertown, N.Y.	200
Rawitzer Bros., Stafford Springs, Conn.	150
Stamford Mfg. Co., Stamford, Conn.	100
Standard Silk Mills, Phillipsburg, N. J.	300
H. B. Smith Co., Westfield, Mass.	150
Skaneateles Paper Co., Skaneateles, N.Y.	75
Sun Electric Co., Woburn, Mass.	300
Taunton Electric Light Co., Taunton. Mass	450
United States cruiser "Boston"	350
Amoskeag Paper Co., Amoskeag, N. H.	75
Allen Bros, Sandy Hill, N. Y.	450
Geo. L. Adams & Co., Stroudsburg, Pa.	75
R. H. Brown & Co., New Haven, Conn.	150
Bigelow Carpet Co., Clinton, Mass.	300
Brigham Factory, Whitman, Mass.	300
Geo. E. Davis, Saccarappa, Me.	450
Derby Paper Co., Birmingham, Conn.	150
L. L. Dean & Co., Amsterdam, N. Y.	100
Edwards Mfg. Co., Augusta, Me.	500
Ellsworth Electric Light Co., Ellsworth, Me.	90
Fairfield Electric Light and Power Co., Fairfield, Me.	650
Chas. S Higgins & Sons, Brooklyn	350
Koch & Shankweilder, Allenton, Pa.	450
Dr. H. H. Kane, Islip, N Y.	75
Lycoming Tannery, Williamsport, Pa	150
Morris Mark, Herkimer. N. Y.	150
James K. Mosser, Allentown, Pa	150
Mosser, Keck & Co., Allentown, Pa.	150
Meriden Britannia Co., Meriden, Conn.	200
Moore, Ames & Thompson, Bellows Falls, Vt.	75
Willimantic Linen Co., Willimantic, Conn.	300
F. G. Wicks, Skaneateles, N. Y.	75
Winston Gas Light Co., Winston, Conn.	300
Stott Woolen Co., Stottville, N. Y.	300
Julius Converse Stafford Springs, Conn.	150
Mauser Mill Co., Treichlers, Pa	150
Calumet Woolen Co., Uxbridge. Mass.	500
Worcester Carpet Co., Worcester, Mass.	340

Also W. R Vanderbilt's residence on Fifth avenue in this city, and his steam yacht "Alva," probably the finest private yacht in the world, are to be lighted by the Swan lamp.

—— The city of Memphis solicits bids for erecting electric light plants for the better illumination of the city.

—— At a meeting of the committee on street lights of Nashua, N. H., open bids for lighting the streets with the electric lights were received, and the Nashua Gas Light Company was awarded the contract.

—— The Suburban Electric Light Company has completed its works in Brookline, and by the first of next week they will be in running order. The quarterly dividend of the Brookline Electric Light Company of 1½ per cent. is now payable.

—— In the common council of Lynn, Mass., the committee on fuel and street lights were instructed to contract for not more than 100 electric lights, at a cost of 47½ cents per light. The committee on ordinances were instructed to frame an ordinance forbidding the use of salt on the horse railroad tracks.

—— The location of the Newton Electric Railroad was not granted by the Board of Aldermen of 1886, but was referred to the 1887 Board. Large numbers of inhabitants of the many villages united for legislation into one city own a horse and carriage—and dislike to have their streets spoiled for driving by the building of street railway. It is the opinion of the inner circles of Neapolitan politicians that a right to build a street railway to be operated by electricity will be granted in the early spring.

—— Professor Barrett, the city electrician of Chicago, under whose guidance the elaborate system of underground conduits for telegraph wires was developed, has proposed an ambitious plan for lighting the entire city with electricity, claiming that it can be done much more brilliantly and at less expense than by the use of gas. The city contemplates trying the system this year to the extent of placing electric lamps along the banks of the Chicago river and at the approaches to the bridges.

Electric Light and Gas Companies.

The electric light has in many ways proved its great advantage over gas, especially in a sanitary point of view, and is gradually superseding gas in many directions where the latter has been in use. This is recognized by the gaslight companies themselves, and as our contemporary, the *Herald*, remarks: "The action of the Boston Gaslight Company in petitioning the Legislature for permission to supply electric lighting to its customers is significant."

It is significant indeed, indicating that this rich and powerful corporation very naturally desires to preserve a monopoly of furnishing light to the people.

Light, water, mail service and telegraphic communication are now public necessities that should not be in the hands of powerful monopolies, who use their privileges to extort all the public will bear in the matter of charges, or who neglect to improve the quality of service or material until forced into it by an indignant community. This we hope our legislature may consider before hastily giving to any corporation or company privileges by which they may enrich themselves at the expense of the public necessities.

That any corporation should receive a good and fair remuneration on its investment goes without saying, but in the matter of furnishing the necessities we have mentioned, due caution should be used that the privilege does not get into the hands of any corporation or set of men without being surrounded by sufficient safeguards—such conditions as will prevent public complaint being ignored or the greed of great gains to interfere with prompt performance of duty in furnishing the best material at the lowest price, after ensuring a moderate profit to the corporation.—*Boston Commercial Bulletin.*

For Hotel Clerks to Remember.

For the benefit of the man who "blows out the gas" it should be generally known that the administration of a few drops of acetic ether on a lump of sugar will usually revive people who have become insensible from the effects of illuminating gas. Hotel clerks should paste this item in their hats.

ELECTRIC LIGHT NEWS

—— Permission will be sought by the council of Columbus, O., to issue bonds to secure the lighting of the city by electricity.

—— The lighting system of the Cumberland Mills, Me, when completed will be large enough for a fair-sized town, comprising 800 incandescent and 20 arc lamps.

—— As will be seen in our business notices, the city of Kewanee, Ill., is ready for the electric light. Mr. H. H. Perkins is the leader in this sensible move.

—— The Fostoria (Ohio) city council has entered into contract with the electric light company of that city for thirty-seven additional street lights, at an annual expense of $3,000.

—— The electric light in the Pittsburgh parks is giving fine satisfaction. They are all on a special line and are carefully watched, and an arrangement has been made with the police to report by telephone whenever there is any trouble on the line, so it can be remedied immediately.

——The Edison Electric Light Company, of New York, has begun in the U. S. Circuit Court at Trenton 11 separate suits against Westinghouse, Church, Kerr & Co., of East Orange N. J., representing the Westinghouse Electric Company, of Pittsburgh, Pa., for alleged infringement of patents covering the system of incandescent electric lighting. Injunctions and orders requiring accounting to be made by the defendants are asked for.

—— The Westinghouse Electric Light Company has purchased the entire property lately occupied by the Union Switch and Signal Company, Pittsburgh, and are installing a large plant of new tools. The testing room is one of the largest in the business, power for which is furnished by two Westinghouse engines of 200 horse-power each, so coupled that a large number of dynamos may be tested at once and for a long run. The Switch and Signal Company has purchased property at Swissvale, and is erecting new works, together with cottages for employes.

—— The following incorporation is announced from Albany: Consolidation of the Edison Electric Light Company with the Edison Company for Isolated Lighting, forming the Edison Electric Light Company. Combined capital stock, $2,080,000. Term of existence is forty-nine years. The amount of the capital stock of the new company is to be $1,294,200, each share $100 par value. The principal business office to be in New York city, but a part of the business to be carried on in South America. The trustees are: Charles Batchelor, Thomas C. Buck, Charles H. Coster, Noah Davis, Thomas A. Edison, A. Foster Higgins, Edward H. Johnson, F. S. Smithers, Anthony J. Thomas, John Tomlinson, Spencer Trask, Erastus Wiman, J. Hood Wright.

—— The Thomson-Houston Electric Light and Power Company, of Quincy, Ill., has made extensive changes and improvements in their plant during the past year. Three new and improved Ball engines have been provided for the electric light station, and a complete complement of steel boilers has been supplied All of the street lamps are new, the old single lights having been replaced with the latest improved double lamps. The lines have also been rebuilt in several localities. There are now 151 street lights, besides the large number of electric lamps in stores and business houses, making Quincy one of the most brilliantly lighted cities in the West. Nearly fifty miles of wire are required for this vast lighting system. In the business portion of the city the lamps are located at every street intersection and in the residence localities at every alternate corner. The system embraces every section of the city, and all the work done by the company is of the most durable and substantial character. Arrangements are now being completed for introducing the Sawyer-Man incandescent electric light A portion of the necessary machinery has already arrived, and within a very short time the smaller lights will be available for business houses and residences.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JAN. 4, 1887.

355,330 Underground wire and steam conduit; Sylvanus D. Locke, Hoosick Falls, N. Y.

355,382 Electrical indicator; William H. Chapman and Berbard C. Donahue, Portland, Me.

355,383 Telephone signal; Charles E. Chinnock, Brooklyn, N. Y.

355,384 Electric alarm; Charles E. Chinnock, Brooklyn, N. Y.

355,400 Mast arm for electric lamps; Thaddeus B. Keeler, Danbury, Ct.

355,420 Prevention of induction in electric circuits; John O. Stockwell, Burlington, Kans.

355,423 Terminals for electric conductors; Frank C. Watkins, Philadelphia, Pa., assignor, by mesne assignments, to the United States Krotophone Company, New York, N. Y.

355,424 Telephone receiver; Frank C. Watkins, Philadelphia, Pa., assignor, by mesne assignments, to the United States Krotophone Company, New York, N. Y.

355,425 Central office telephone switchboard; Frank C. Watkins, Philadelphia, Pa., assignor, by mesne assignments, to the United States Krotophone Company, New York, N. Y.

355,431 Telegraph receiving instrument; William Arthur, Gainesville, Fla.

355,434 Electric clock winding attachment; Jos. Brolch and Adolph E. G. Luebke, Brooklyn, N. Y.

355,443 Method of suspending electric lights; Henry E. Edwards, Providence, R. I., assignor of one-half to the American Electrical Works, same place.

355,446 Safety circuit for electric lights; Edwin T. Greenfield, New York, N. Y., assignor to himself and Sigmund Bergmann, same place.

355,468, 355,469, 355,470 Railway telegraphy; Lucius J. Phelps, New York, N. Y., assignor to the Railway Telegraph Company.

355,491, 355,492, 355,493 Cable hanger; George L. Wiley, Brooklyn, N. Y., assignor to the Standard Underground Cable Company, Pittsburgh, Pa.

355,548 Signal box; August Meyer, Baltimore, Md., assignor to J. Frank Morrison, same place.

355,611 Coupling for electric wires; Henry Howson, Philadelphia, Pa.

355,662 Printing telegraph; Daniel E. Pike, New York, N. Y., assignor of one-half to Ralph W. Pope, Elizabeth, N. J.

BUSINESS NOTICE.

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court (7 Beekman St.,) New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed, to succeed N. S. Keith, of the patent agency of the *Electrical World* and Associate Editor. N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World's* Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend." —*New York Observer.*

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—OF—

The National Electric Light Assoc'n.

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—AT THE—

HOTEL LAFAYETTE,

—ON—

TUESDAY, FEBRUARY 15, '87

AT 12 O'CLOCK M.

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Fig.259

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Fig.255

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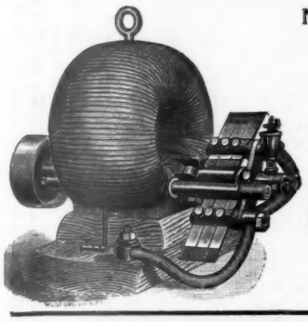

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A. W. MOSS, Secretary.

Plymouth, Pa., Jan. 8, 1887.

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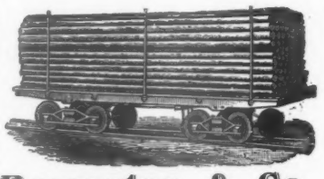

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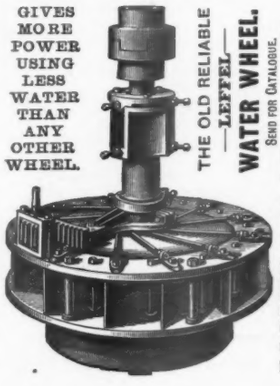

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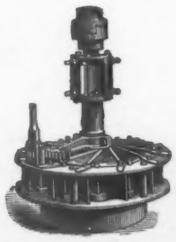

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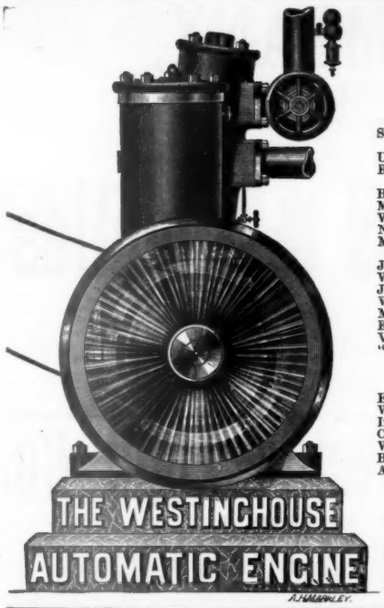

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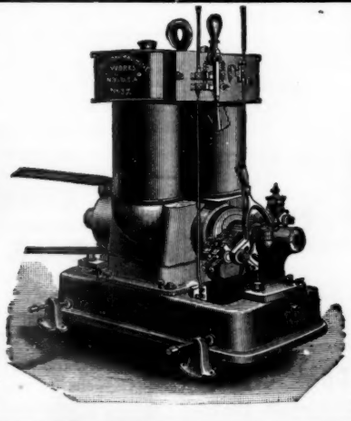

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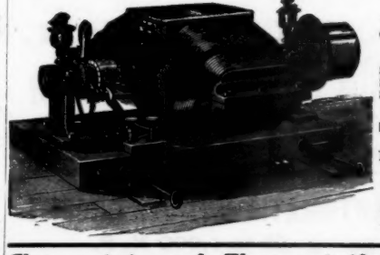

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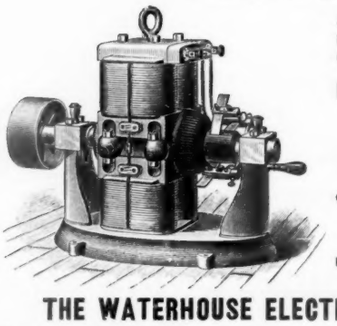

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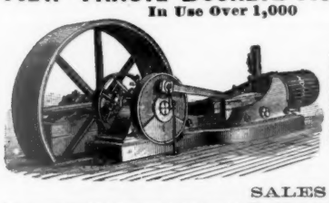

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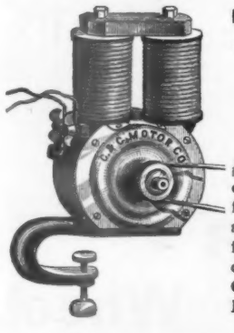

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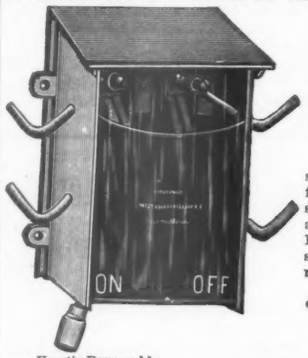

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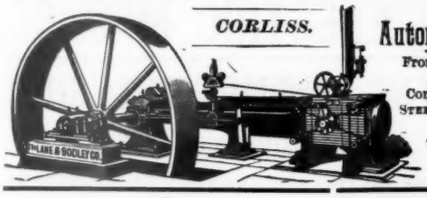

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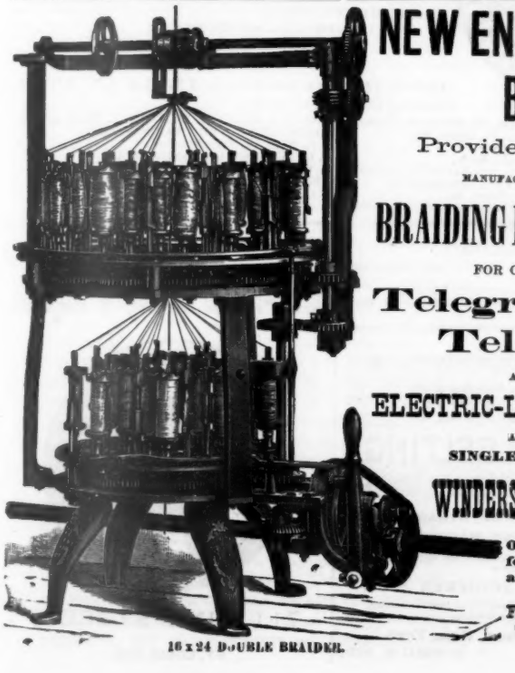

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